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(54) ORGANIC ELECTROLUMINESCENT ELEMENT AND DISPLAY DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To provide an organic electroluminescent element with high luminous efficiency and long life and a display device with low power consumption and a long life using this element, and provide a low cost display device using the organic electroluminescent element and a color conversion layer.
SOLUTION: The electroluminescent element has a cathode, an anode, and a luminous layer, and the luminous layer contains an organic compound having a band gap of 2.96-3.80 eV and a molecular weight of 600-2,000, and a phosphor.

LEGAL STATUS

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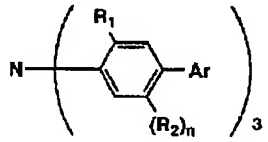
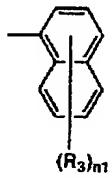
CLAIMS

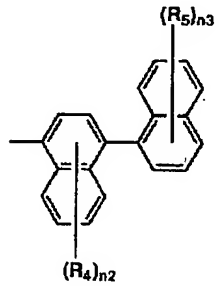
[Claim(s)]
[Claim 1] The organic electroluminescent element which is an organic electroluminescent element which has cathode, an anode plate, and a luminous layer, and is characterized by having a 2.96-3.80eV band gap in this luminous layer, and containing the organic compound and fluorescent substance whose molecular weight is 600-2000.
[Claim 2] The organic electroluminescent element according to claim 1 to which said organic compound is characterized by having at least one nitrogen atom in intramolecular.
[Claim 3] The organic electroluminescent element according to claim 1 or 2 to which said organic compound is characterized by being the heterocyclic compound which has at least one hetero atom in intramolecular.
[Claim 4] The organic electroluminescent element according to claim 1 or 2 characterized by expressing said organic compound with the following general formula (I).
[Formula 1]
一般式(I)



(R1 and R2 express a substituent respectively among a formula, Ar expresses the aromatic hydrocarbon ring which may have the substituent, or an aromatic series heterocycle radical, and n expresses the integer of 0-3.)
[Claim 5] The organic electroluminescent element according to claim 4 to which Ar in said general formula (I) is characterized by what is expressed with a general formula (II).
[Formula 2]
一般式(II)

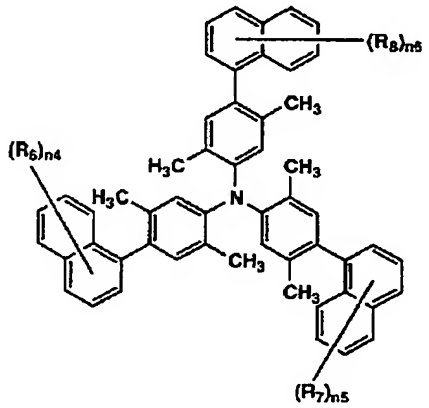


(One or more R3 expresses a substituent respectively among a formula, and n1 expresses the integer of 0-7.)
[Claim 6] The organic electroluminescent element according to claim 4 to which Ar in said general formula (I) is characterized by what is expressed with a general formula (III).
[Formula 3]
一般式(III)

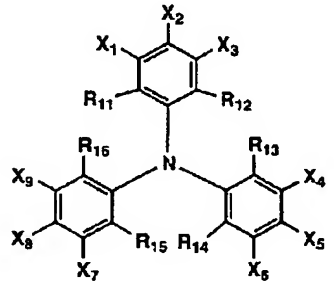


(One or more R4 and R5 express a substituent respectively among a formula, n2 expresses the integer of 0-6, and n3 expresses the integer of 0-7.)

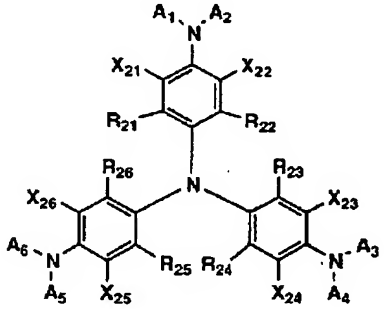
[Claim 7] The organic electroluminescent element according to claim 1 or 2 characterized by expressing said organic compound with the following general formula (IV).
[Formula 4]
一般式(IV)



(One or more R6, R7, and R8 express among a formula the substituent respectively chosen from an alkyl group, a cycloalkyl radical, an aryl group, a halogen, an alkoxy group, an aryloxy group, and a heterocycle radical, and n4, n5, and n6 express the integer of 0-7 respectively.)
[Claim 8] The organic electroluminescent element according to claim 1 or 2 characterized by expressing said organic compound with the following general formula (V).
[Formula 5]
一般式(V)



(Even if R11-R16, and X1-X9 express a hydrogen atom or a substituent among a formula and it differs, respectively, may be the same.) However, the total value of each solid parameter [of R11-R16] EsR11 - EsR16 value fills EsR11+EsR12+EsR13+EsR14+EsR15+EsR16 <=-2.0.
[Claim 9] The organic electroluminescent element according to claim 1 or 2 characterized by expressing said organic compound with the following general formula (VI).
[Formula 6]
一般式(VI)



(R21-R26, X21-X26, and A1-A6 express a hydrogen atom or a substituent among a formula.) However, the total value of each solid parameter EsR21-EsR26 of R21-R26 fills EsR21+EsR22+EsR23+EsR24+EsR25+EsR26 <=-2.0.
[Claim 10] An organic electroluminescent element given in any 1 term of claims 1-9 characterized by the band gap of said organic compound being 3.20-3.60eV.
[Claim 11] An organic electroluminescent element given in any 1 term of claims 1-10 characterized by having a cathode buffer layer between cathode and a luminous layer.
[Claim 12] The display characterized by having the organic electroluminescent element of a publication in any 1 term of claims 1-11.

[Claim 13] The full color display characterized by juxtaposing an organic electroluminescent element given in two or more sorts which have different luminescence maximum wave length of any 1 terms of claims 1-11 on the same substrate.
[Claim 14] The full color display according to claim 13 with which a band gap is characterized by the organic compounds contained in two or more sorts which have different luminescence maximum wave length of organic electroluminescent elements being [2.96-3.80eV and molecular weight] the same compounds of 600-2000.
[Claim 15] The display characterized by having the conversion layer which emits light in the light of maximum wave length who absorbs luminescence of an organic electroluminescent element according to claim 1 to 11, and is different from it.
[Claim 16] The full color display characterized by juxtaposing two or more sorts of luminescence units which consist of a conversion layer which emits light in the light of maximum wave length who absorbs luminescence of an organic electroluminescent element according to claim 1 to 11 and an organic electroluminescent element, and is different from it on the same substrate.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the display which has an organic electroluminescent element and it excellent in luminescence brightness and a life in detail about an organic electroluminescence (it may be written as organic electroluminescence below) component, and a display.
[0002]
[Description of the Prior Art] There is an electroluminescence display (ELD) as an electronic display device of a luminescence mold. As a component of ELD, an inorganic electroluminescent element and an organic electroluminescent element are mentioned. Although the inorganic electroluminescent element has been used as the flat-surface mold light source, in order to make a light emitting device drive, the high voltage of an alternating current is required. An organic electroluminescent element has the configuration which sandwiched the luminous layer containing the compound which emits light in cathode and an anode plate, and pours an electron and an electron hole into a luminous layer. It is the component which emits light using emission (fluorescence and phosphorescence) of the light at the time of making an exciton (exciton) generate and this exciton deactivating by making it recombine. severalV- dozens — light can be emitted on about V electrical potential difference, further, since it is a self-luminescence mold, it is rich in an angle of visibility, and visibility is high, and since it is the perfect solid-state component of a thin film mold, it is observed from viewpoints, such as space-saving and portability.
[0003] However, the organic electroluminescent element towards future utilization is expected development of efficient, high brightness, and the organic electroluminescent element that emits light long lasting with the further low power. Moreover, development of the organic electroluminescent element of low cost is desired.
[0004] As a means of improvement in luminous efficiency, and the reinforcement of a component, the fluorescent substance of a minute amount (less than [10 mol %]) is mixed into the luminous layer of an organic electroluminescent element, and the technique (doping) of changing luminescence from a luminous layer into luminescence from a fluorescent substance is known. The following are mentioned as a technique of concrete doping.
[0005] In patent No. 3093796, the fluorescent substance of a minute amount was doped to the stilbene derivative, the JISUCHIRIRU arylene derivative, or the tris styryl arylene derivative, and improvement in luminous efficiency and the reinforcement of a component are attained to it.
[0006] Moreover, the component (JP,3-255190,A) which has the organic luminous layer which doped Quinacridone system coloring matter to this is known by using as a host compound the component (JP,63-264692,A) and 8-hydroxy kino RINARU minium complex which have the organic luminous layer which doped the fluorescent substance of a minute amount to this, using a 8-hydroxy kino RINARU minium complex as a host compound.
[0007] However, also in such doping, improvement in luminous efficiency and the reinforcement of a component cannot say that it is enough, but improvement in the further luminous efficiency and the reinforcement of a component are called for.
[0008] Moreover, luminescence from an organic electroluminescent element is absorbed and the method of obtaining luminescence of the maximum luminescence wavelength different from it is learned for patent No. 2795932, JP,9-245511,A, 5-258860, etc. The organic fluorochrome is illustrated as a compound which changes luminescence of an organic electroluminescent element. The desired luminescent color can be obtained only by changing the organic fluorescent substance used for a color conversion layer, complicated patterning which manufacture of full color organic electroluminescence usually takes becomes unnecessary, and low-cost-izing is possible for the configuration of the above-mentioned patent. However, the organic electroluminescent element of a publication was not enough as luminescence reinforcement for the above-mentioned patent, and the reinforcement of luminescence obtained after conversion was not still enough.
[0009]
[Problem(s) to be Solved by the Invention] The first purpose of this invention is offering the improvement in luminous efficiency or the organic electroluminescent element which carried out reinforcement and the low power which used this, and a long lasting display. The second purpose is offering the display of the low cost which used this organic electroluminescent element and a color conversion layer.
[0010]
[Means for Solving the Problem] The above-mentioned purpose of this invention was attained by the following configuration.

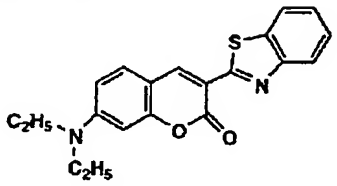
[0011] 1. Organic electroluminescent element which is organic electroluminescent element which has cathode, anode plate, and luminous layer, and is characterized by having 2.96-3.80eV band gap in this luminous layer, and containing organic compound and fluorescent substance whose molecular weight is 600-2000.
[0012] 2. Organic electroluminescent element given in the above 1 said whose organic compound is characterized by having at least one nitrogen atom in intramolecular.
[0013] 3. Organic electroluminescent element given in the above 1 or 2 said whose organic compounds are characterized by being heterocyclic compound which has at least one hetero atom in intramolecular.
[0014] 4. Organic electroluminescent element given in the above 1 or 2 characterized by expressing said organic compound with above-mentioned general formula (I).
[0015] 5. Organic electroluminescent element given in the above 4 whose Ar in said general formula (I) is characterized by what is expressed with above-mentioned general formula (II).
[0016] 6. Organic electroluminescent element given in the above 4 whose Ar in said general formula (I) is characterized by what is expressed with above-mentioned general formula (III).
[0017] 7. Organic electroluminescent element given in the above 1 or 2 characterized by expressing said organic compound with above-mentioned general formula (IV).
[0018] 8. Organic electroluminescent element given in the above 1 or 2 characterized by expressing said organic compound with above-mentioned general formula (V).
[0019] 9. Organic electroluminescent element given in the above 1 or 2 characterized by expressing said organic compound with above-mentioned general formula (VI).
[0020] 10. An organic electroluminescent element given in any 1 term of the above 1-9 characterized by the band gap of said organic compound being 3.20-3.60eV.
[0021] 11. An organic electroluminescent element given in any 1 term of the above 1-10 characterized by having a cathode buffer layer between cathode and a luminous layer.
[0022] 12. The display characterized by having the organic electroluminescent element of a publication in any 1 term of the above 1-11.
[0023] 13. The full color display characterized by juxtaposing an organic electroluminescent element given in any 1 term of two or more sorts which have different luminescence maximum wave length of above 1-11 on the same substrate.
[0024] 14. A full color display given in the above 13 whose band gap is characterized by the organic compounds contained in two or more sorts which have different luminescence maximum wave length of organic electroluminescent elements being [2.96-3.80eV and molecular weight] the same compounds of 600-2000.
[0025] 15. The display characterized by having the conversion layer which emits light in the light of maximum wave length who absorbs luminescence of the organic electroluminescent element of a publication to the above 1-11, and is different from it.
[0026] 16. The full color display characterized by juxtaposing two or more sorts of luminescence units which consist of a conversion layer which emits light in the light of maximum wave length who absorbs luminescence of the organic electroluminescent element of a publication, and an organic electroluminescent element to the above 1-11, and is different from it on the same substrate.
[0027] This invention is explained to a detail below. this invention person found out wholeheartedly that the improvement in luminous efficiency or the organic electroluminescent element which carried out reinforcement was obtained by having a 2.96-3.80eV band gap in a luminous layer, and containing the organic compound and fluorescent substance whose molecular weight is 600-2000 as a result of research. Moreover, in order to discover the effectiveness of this invention more, it is desirable that the above-mentioned organic compound is a specific organic compound [like] according to claim 2 to 10.
[0028] Moreover, it found out that a low power, a long lasting display, and/or a full color display were obtained by using this organic electroluminescent element and/or a conversion layer.
[0029] Next, the band gap of the organic compound used for this invention is explained. The band gaps as used in the field of this invention are the ionization potential of a compound, and the difference of an electron affinity. Ionization potential and an electron affinity are determined on the basis of vacuum level. Ionization potential is defined by energy required to emit the electron in the HOMO (highest occupied molecular orbital) level of a compound to vacuum level, and an electron affinity is defined by the energy which the electron in vacuum level falls and stabilizes on the LUMO (minimum sky molecular orbital) level of the matter.
[0030] In this invention, a band gap measures the absorption spectrum of the vacuum evaporationo film when vapor-depositing 100nm of organic compounds on glass, and converts and asks XeV for the wavelength Ynm of the absorption end. The following conversion types are used at this time.
[0031] Y= 107/(8065. 541xX)
In addition, even if ionization potential amends the oxidation potential which measured directly by photoelectron spectroscopy or was measured electrochemically to a reference electrode, it is searched for. In the case of the latter, it is expressed with the ionization potential = oxidation potential (vs.S C E) of +4.3eV when for example, a saturation calomel electrode (S C E) is used as a reference electrode ("Molecular Semiconductors", Springer-Verlag, 1985, 98 pages).
[0032] By this invention, the ionization potential Ip of an organic compound was measured directly by photoelectron spectroscopy. Specifically, it considered as the value measured with the low-energy-electron-spectroscopy equipment "Model AC-1" by Riken Keiki Co., Ltd.

[0033] Moreover, the electron affinity was searched for according to the following formula which is a definition type of a band gap.
(Band gap) = (ionization potential) - (electron affinity)
Moreover, it is the substituent constant defined by Taft in the solid parameter Es of the substituent in this invention, for example, is indicated by "field special number No. 122 Nankodo Co., Ltd. ** of the structure-activity relationship chemistry of a drug." On the basis of a hydrogen atom, Es value said especially by this invention is a value of Es (H= 0), namely, shows the value which deducted 1.24 from Es (CH 3= 0) value on the basis of a methyl group. The typical value is shown in Table 1.
[0034]
[Table 1]

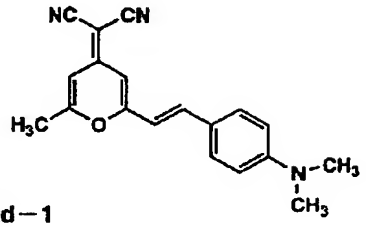
置換基	Es 値
H	0.00
CH_3	−1.24
C_2H_5	−1.31
i−C_3H_7	−1.71
t−C_4H_9	−2.78
F	−0.46
Cl	−0.97
Br	−1.16
CF_3	−2.40
CCl_3	−3.30
OCH_3	−0.55
OH	−0.55
SH	−1.07
CN	−0.51

[0035] Next, a luminous layer is explained. The luminous layer as used in this specification points out the layer which emits light when a current is passed to the electrode which consists of cathode and an anode plate in the sense of a wide sense. The layer containing the organic compound which emits light when a current is specifically passed to the electrode which consists of cathode and an anode plate is pointed out. Usually, a luminous layer takes the structure which pinches a luminous layer between the electrodes of a pair. The organic electroluminescent element of this invention has an electron hole transportation layer, an electronic transportation layer, an anode plate buffer layer, a cathode buffer layer, etc. other than a luminous layer if needed, and takes the structure ****(ed) in cathode and an anode plate.
[0036] Specifically, there is structure of (1) anode plate / luminous layer / cathode (2) anode plate / electron hole transportation layer / luminous layer / cathode (3) anode plate / luminous layer / electronic transportation layer / cathode (4) anode plate / electron hole transportation layer / luminous layer / electronic transportation layer / cathode (5) anode plate / anode plate buffer layer / electron hole transportation layer / luminous layer / electronic transportation layer / cathode buffer layer / cathode.
[0037] The luminous layer of this invention has a 2.96-3.80eV band gap, and is formed of the organic compound whose molecular weight is 600-2000, and the layer containing a fluorescent substance.
[0038] Here, by containing a fluorescent substance, for the case where it does not contain, luminescence of different maximum luminescence wavelength is the compound obtained from an organic electroluminescent element, and, as for a fluorescent substance given in this invention, it is desirable that a band gap is small as compared with said organic compound.
[0039] A desirable fluorescent substance is a fluorescence organic molecule with a high fluorescence quantum yield, or a rare earth complex system fluorescent substance in the state of a solution. Here, 30% or more of especially a fluorescence quantum yield is desirable 10% or more.
[0040] As a fluorescence organic molecule with a high fluorescence quantum yield, commercial laser coloring matter etc. is mentioned, for example, coumarin system coloring matter, pyran system coloring matter, cyanine system coloring matter, crocodile NIUMU system coloring matter, SUKUARIUMU system coloring matter, oxo-Benz anthracene system coloring matter, fluorescein system coloring matter, rhodamine system coloring matter, pyrylium system coloring matter, perylene system coloring matter, stilbene system coloring matter, poly thiophene system coloring matter, etc. are mentioned.
[0041] Although the example of the fluorescence organic molecule used for below by this invention is shown, this invention is not limited to these.
[0042]
[Formula 7]

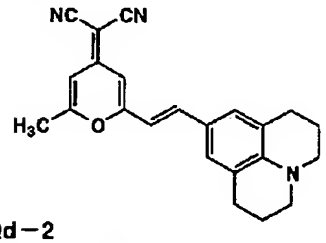
Coumarin6



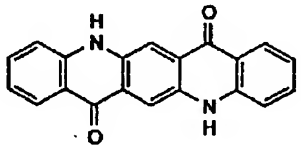
DCM1



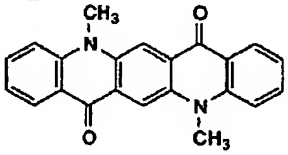
DCM2



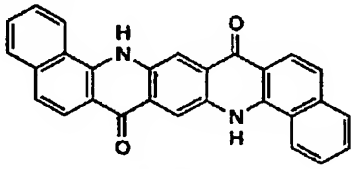
Qd－1



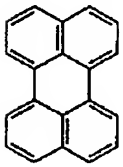
Qd－2



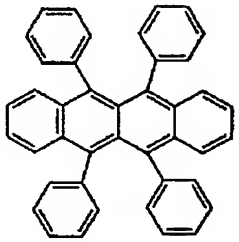
Qd－3



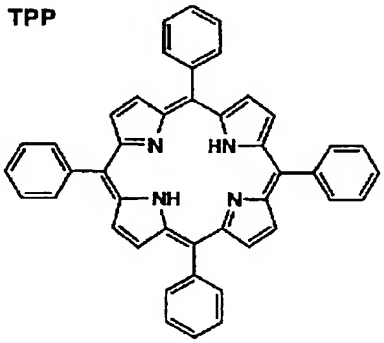
Perylene



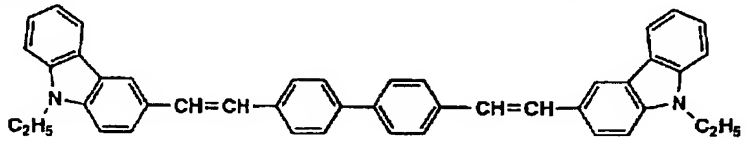
Rubrene



TPP



BCzVBi



[0043] Moreover, as an example of a rare earth complex system fluorescent substance, the rare earth complex system fluorescent substance used for the below-mentioned color conversion layer is mentioned.
[0044] moreover -- said organic compound is an organic compound which has at least one nitrogen atom in intramolecular -- further -- high brightness -- emitting light -- more -- high -- an organic brightness electroluminescent element can be offered.
[0045] furthermore -- said organic compound is a heterocyclic compound which has at least one hetero atom -- more -- much more -- high brightness -- emitting light -- further -- high -- an organic brightness electroluminescent element can be offered.
[0046] It is desirable that it is the compound expressed with following general formula (I) - (VI) as an organic compound which has at least one nitrogen atom of this invention. The compound expressed with general formula [of this invention] (I) - (VI) below is explained in detail.
[0047] In said general formula (I), n expresses the integer of 0-3, R1 and R2 express a substituent respectively, and alkyl groups (methyl, ethyl, i-propyl, hydroxyethyl, methoxymethyl, trifluoromethyl, t-butyl, etc.), halogen atoms (fluorine, chlorine, etc.), and alkoxy groups (methoxy and ethoxy **i-propoxy, butoxy, etc.) are mentioned preferably as a substituent. Ar expresses the aromatic hydrocarbon ring which may have the substituent, or an aromatic series heterocycle radical, and expresses naphthyl, binaphthyl, quinolyl, iso quinolyl, benzoxazolyl, benzimidazolyl, etc. preferably. When n expresses two or more integers, even if two or more R1 and R2 are the same, they may differ.
[0048] In the general formula (II), n1 expresses the integer of 0-7, and one or more R3 expresses a substituent, and even if respectively the same, it may differ. as a substituent -- halogen atoms (fluorine, chlorine, etc.) and an alkyl group (methyl --) Ethyl, i-propyl, hydroxyethyl, methoxymethyl, trifluoromethyl, Cycloalkyl radicals, such as t-butyl (cyclopentyl, cyclohexyl, etc.), aralkyl radicals (benzyl, 2-phenethyl, etc.) and an aryl group (phenyl --) alkoxy groups

(methoxy —), such as naphthyl, p-tolyl, and p-chlorophenyl Aryloxy groups, such as ethoxy **i-propoxy and butoxy one (phenoxy etc.), A cyano group, heterocycle radicals (pyrrolyl, pyrrolidyl, pyrazolyl, imidazolyl, pyridyl, benzimidazolyl, bends thiazolyl, benzoxazolyl, etc.), etc. may be mentioned, and these radicals may be permuted further.

[0049] In a general formula (III), n2 expresses the integer of 0-6, and n3 expresses the integer of 0-7. Even if one or more R4 and R5 express a substituent and differ from each other, respectively, even when they are the same, they are good. As a substituent, what was mentioned as the above-mentioned example of R3, and the same thing may be mentioned, and these radicals may be permuted further.

[0050] In a general formula (IV), n4, n5, and n6 express the integer of 0-7 respectively. One or more R6, R7, and R8 express the substituent respectively chosen from an alkyl group, a cycloalkyl radical, an aryl group, a halogen, an alkoxy group, an aryloxy group, and a heterocycle radical, and a methyl group and especially its a naphthyl group are desirable.

[0051] When n1-n6 express two or more integers, even if two or more R3-R8 are the same, they may differ.

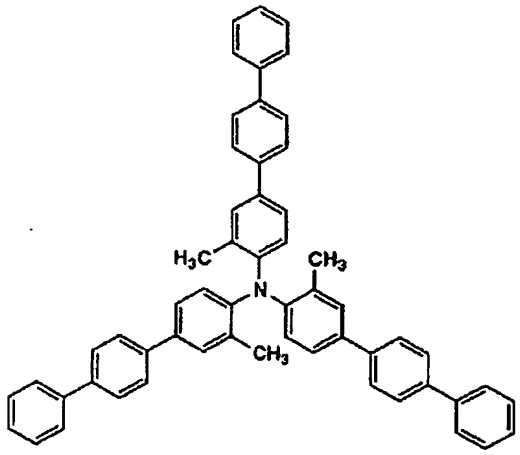
[0052] In a general formula (V) and (VI), even if R11-R16, R21-R26, X1-X9, and A1-A6 express a hydrogen atom or a substituent and they differ from each other, respectively, even when they are the same, they are good. However, the total value of each solid parameter [of R11-R16] EsR11 - EsR16 value fills EsR11+EsR12+EsR13+EsR14+EsR15+EsR16 <=-2.0, and the total value of each solid parameter [of R21-R26] EsR21 - EsR26 value fills EsR21+EsR22+EsR23+EsR24+EsR25+EsR26 <=-2.0. In addition, the substituent which adjoins mutually is condensed and may form the ring structure. As a substituent expressed with X1-X9, an alkyl group, an aryl group, a heterocycle radical, a halogen atom, an alkoxy group, the amino group, etc. are desirable, and, as for especially X2, X5, and X8, it is still more desirable that they are an aryl group or an amino group (especially diaryl amino group). Moreover, as for the substituent expressed with A1-A6, it is desirable that it is an aryl group, and these radicals may be permuted further.

[0053] Although the example of a compound expressed with general formula (I) - (VI) in this invention below is shown, this invention is not limited to these.

[0054]

[Formula 8]

(1)



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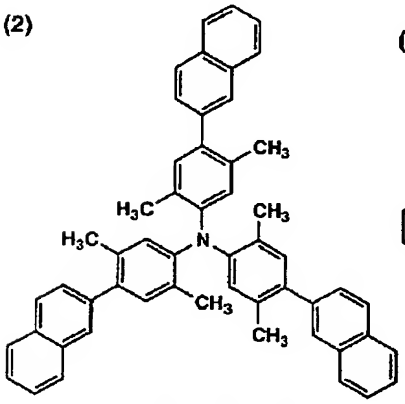

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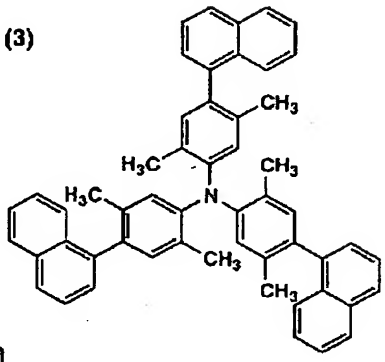

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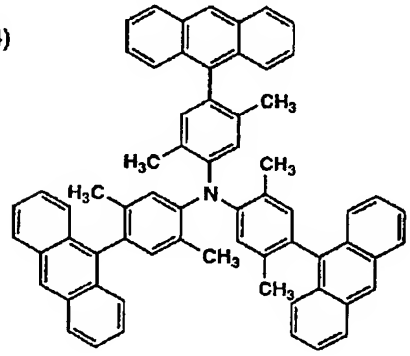
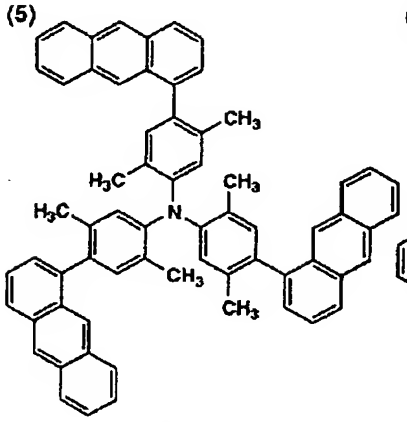


[0055]
[Formula 9]

(5)



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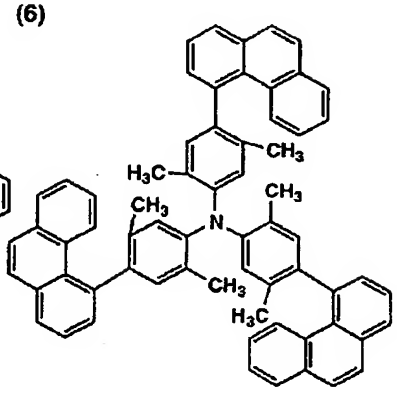

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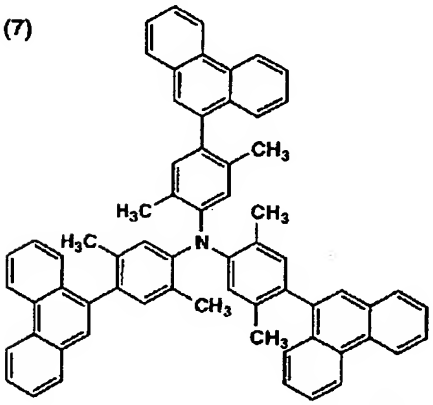

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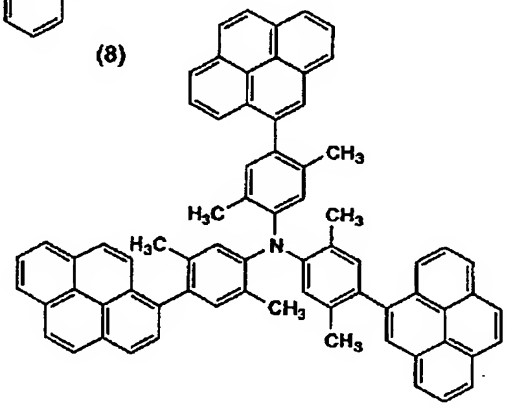
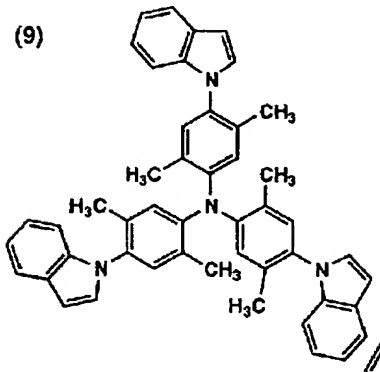


[0056]
[Formula 10]

(9)



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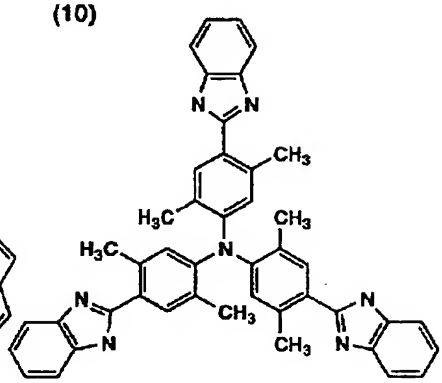

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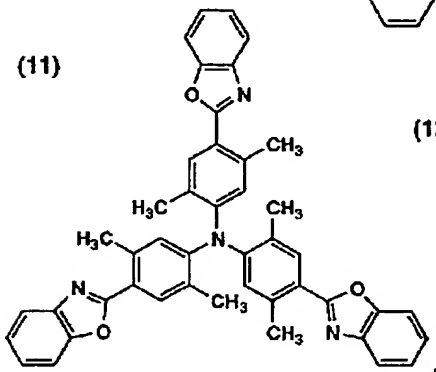

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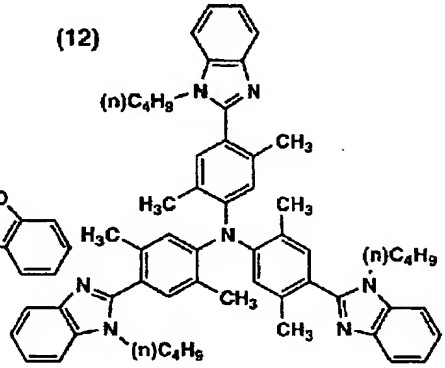

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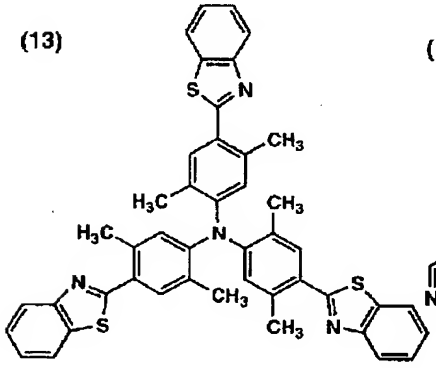

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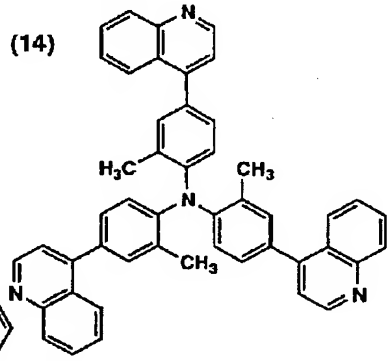
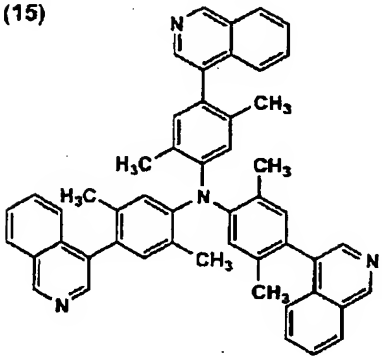


[0057]
[Formula 11]

(15)



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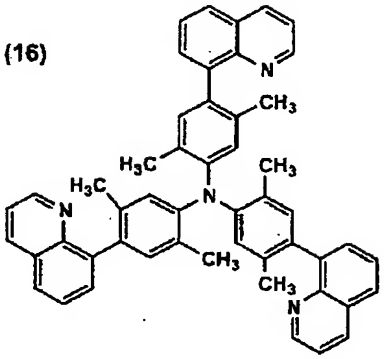

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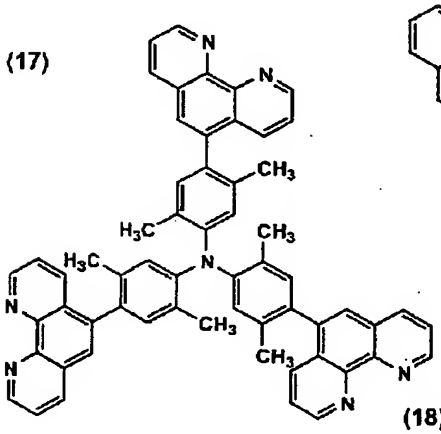

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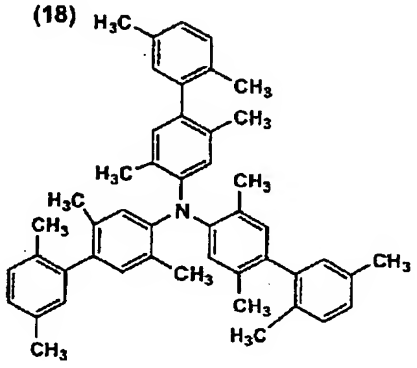
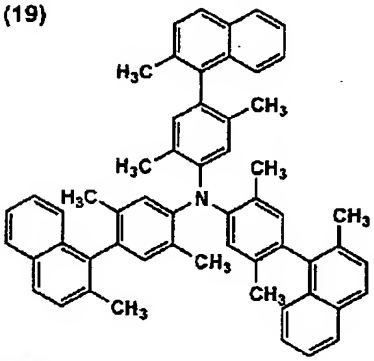


[0058]
[Formula 12]

(19)



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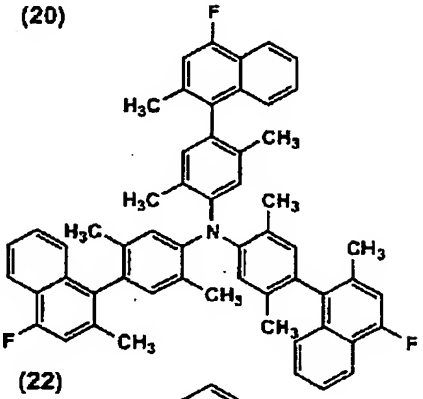

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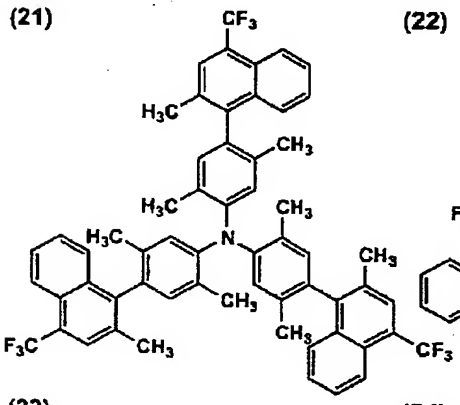

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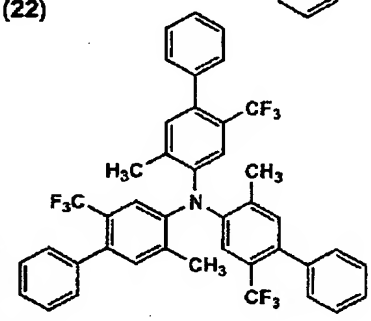

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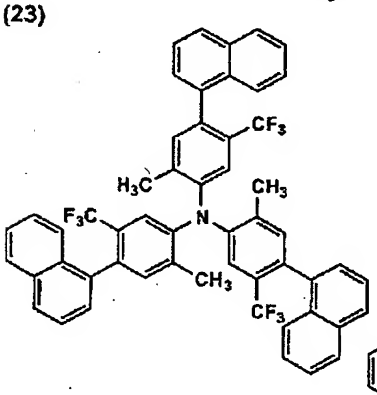

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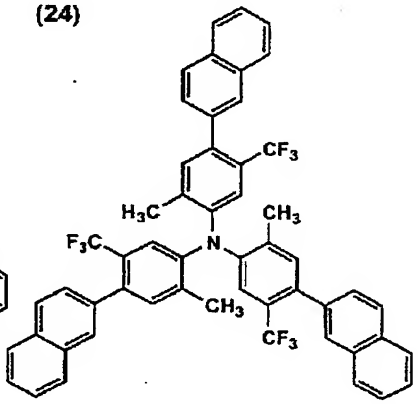
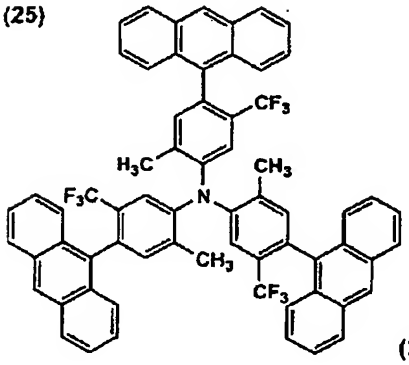


[0059]
[Formula 13]

(25)



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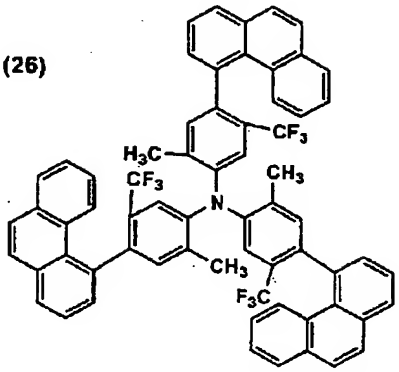

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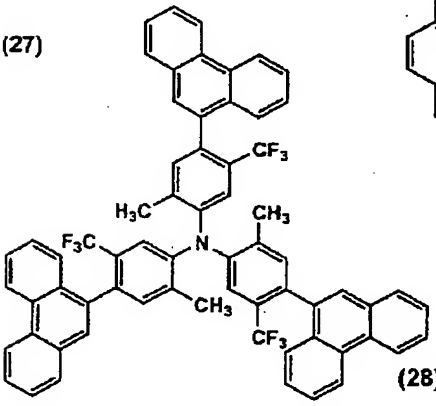

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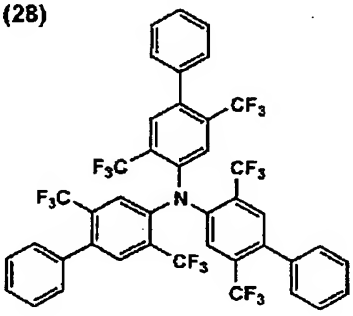
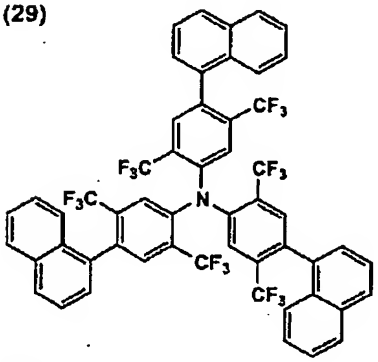


[0060]
[Formula 14]

(29)



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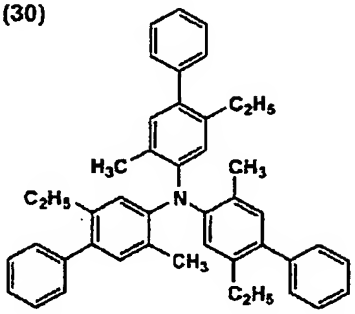

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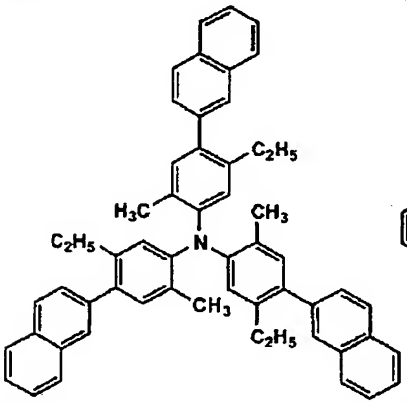

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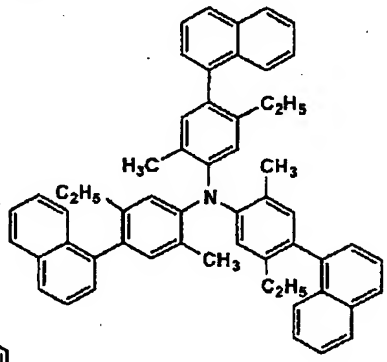

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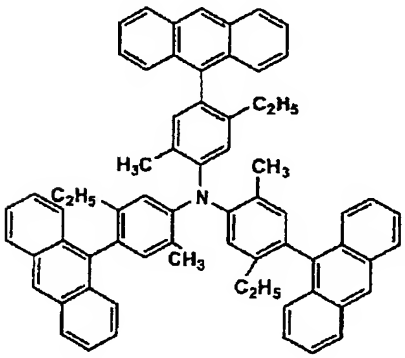

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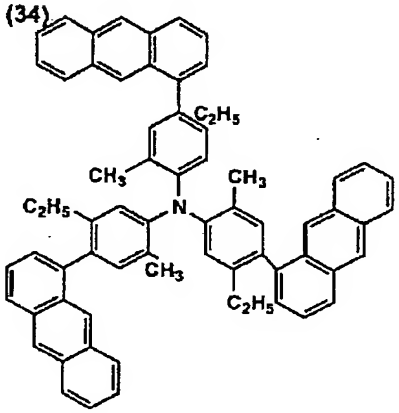
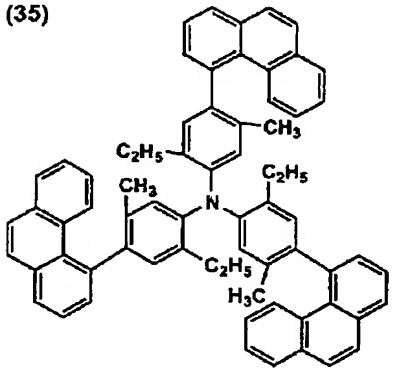


[0061]
[Formula 15]

(35)



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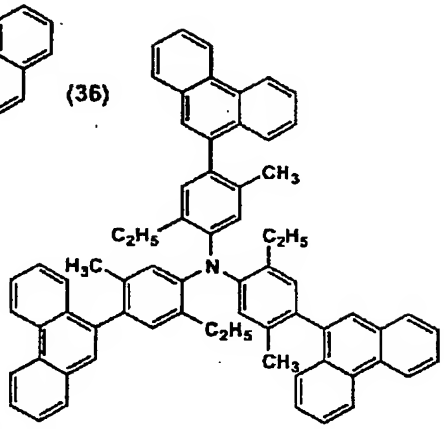

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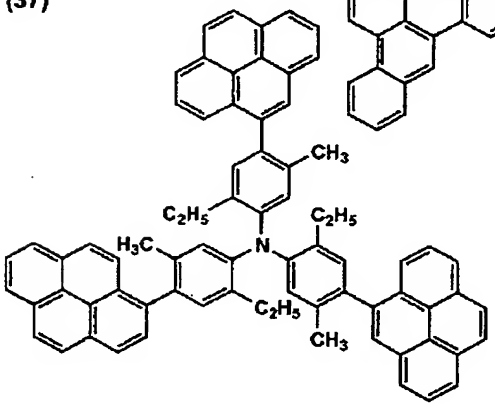
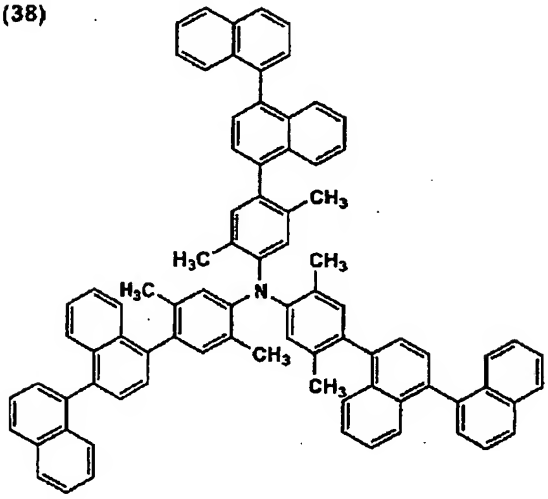


[0062]
[Formula 16]

(38)



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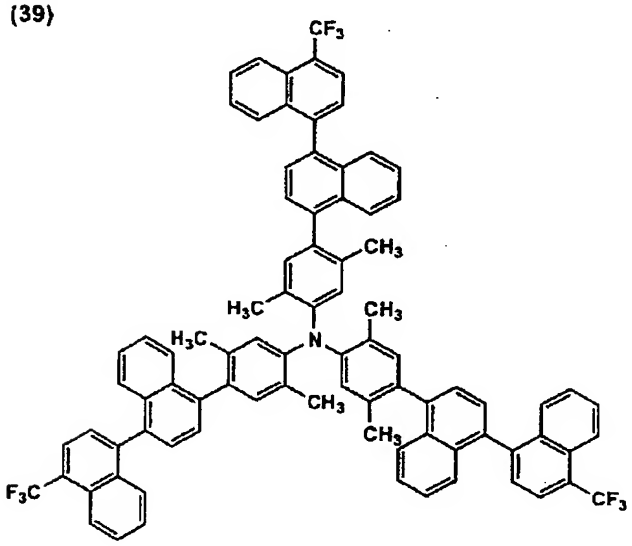
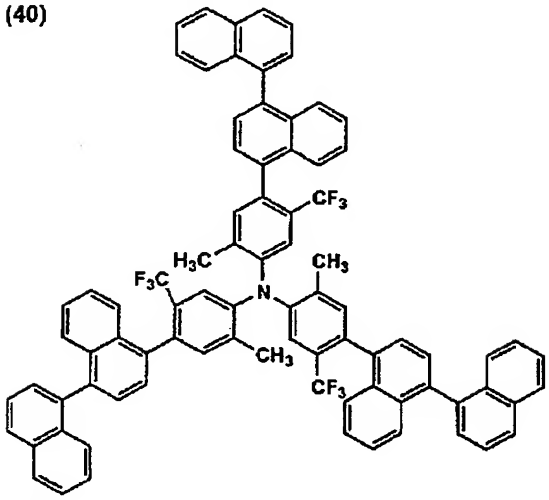


[0063]
[Formula 17]

(40)



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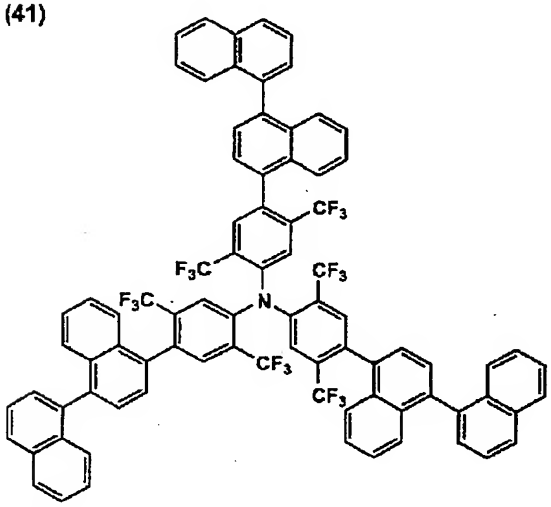
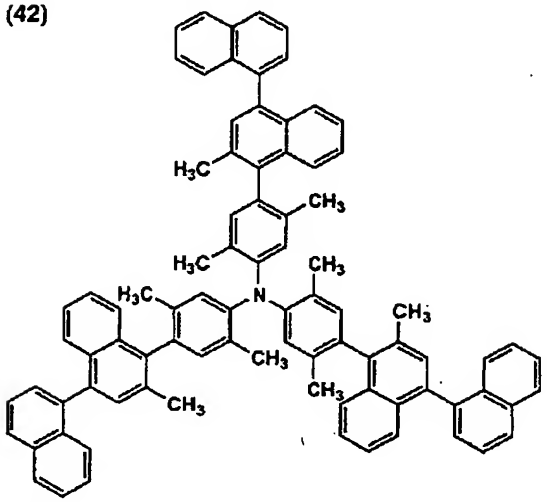


[0064]
[Formula 18]

(42)



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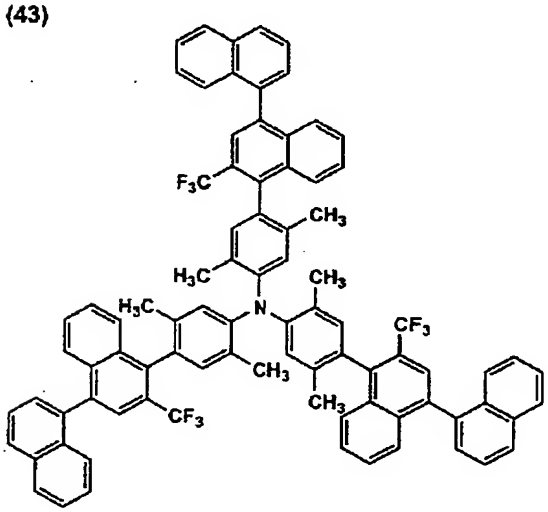
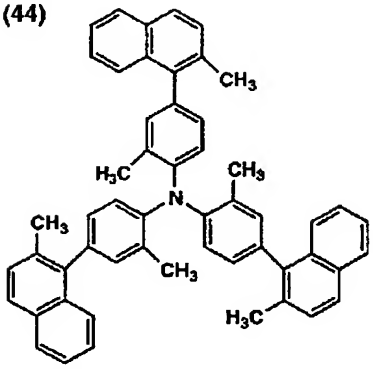


[0065]
[Formula 19]

(44)



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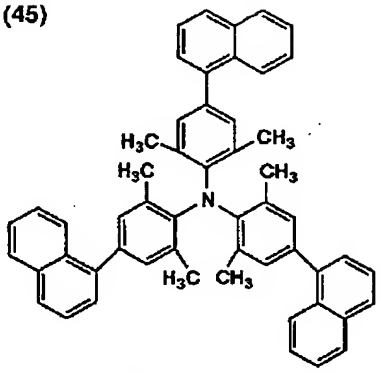

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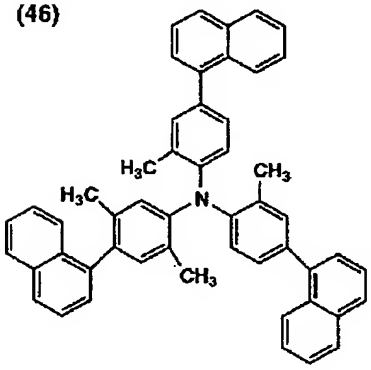

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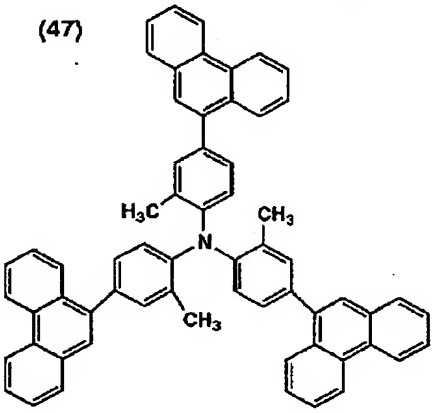

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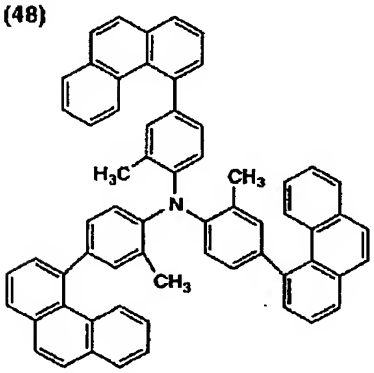

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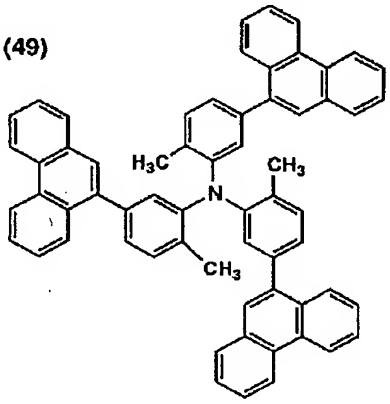
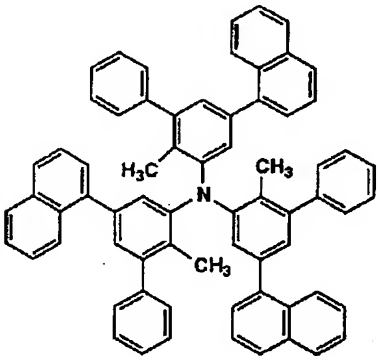


[0066]
[Formula 20]

(50)



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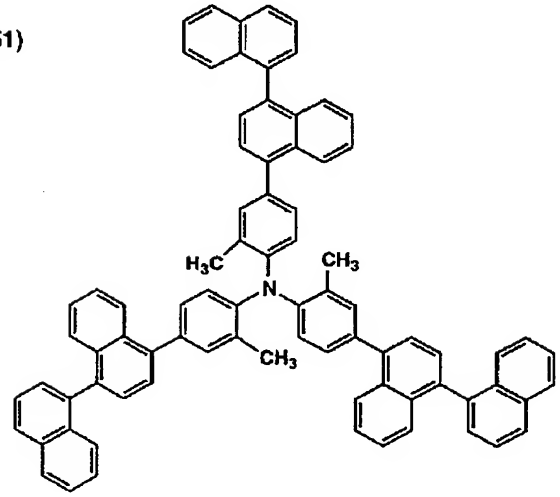
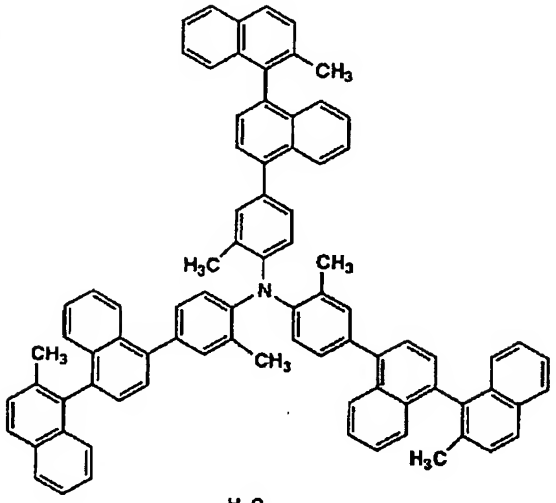


[0067]
[Formula 21]

(52)



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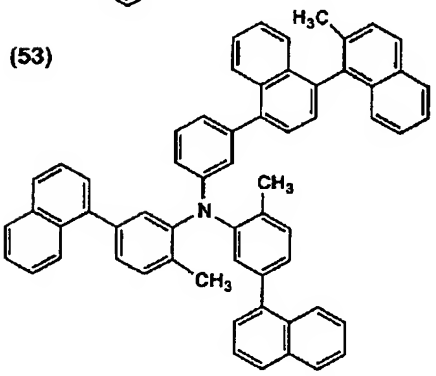

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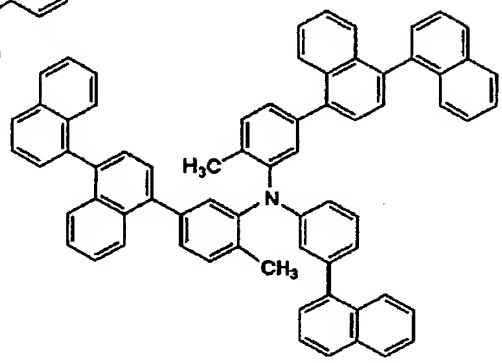
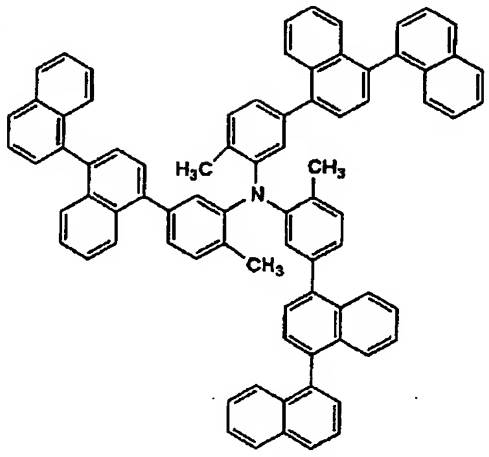


[0068]
[Formula 22]

(55)



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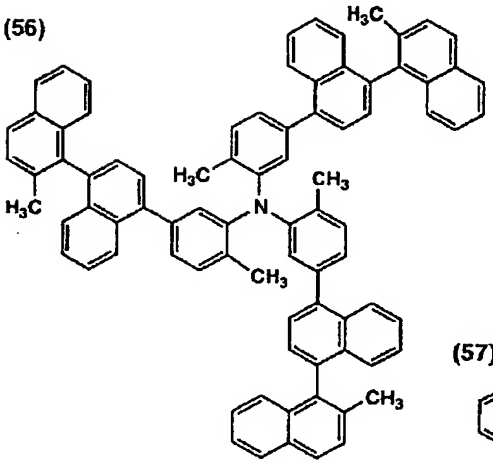

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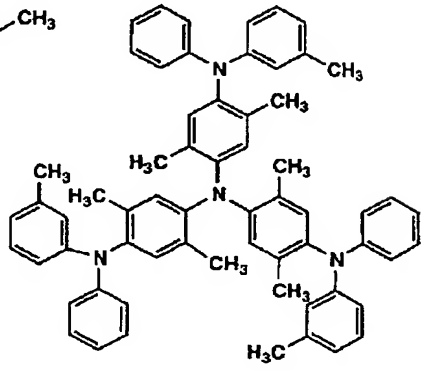
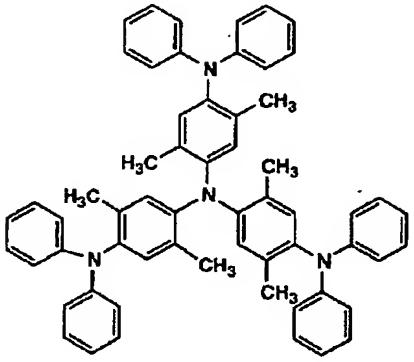


[0069]
[Formula 23]

(58)



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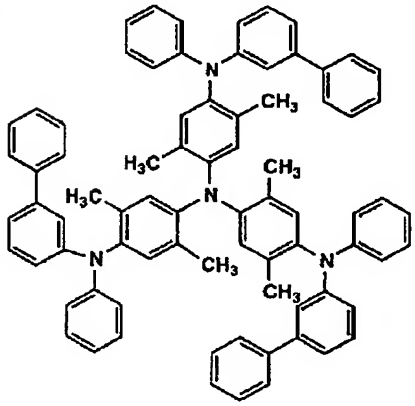

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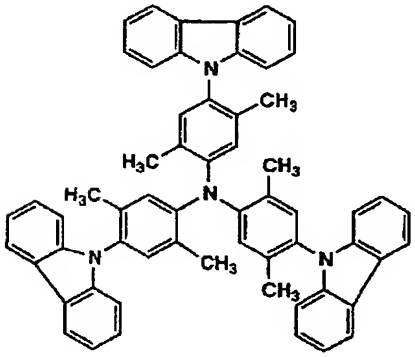
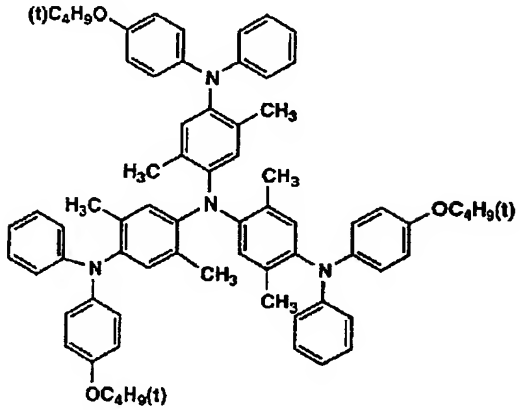


[0070]
[Formula 24]

(61)



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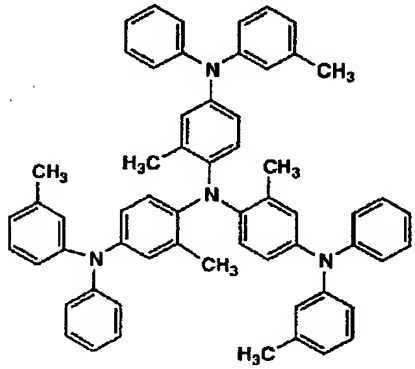

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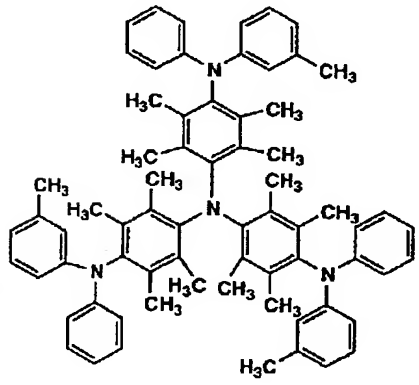
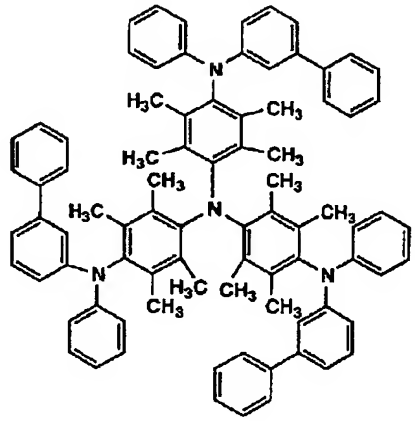


[0071]
[Formula 25]

(64)



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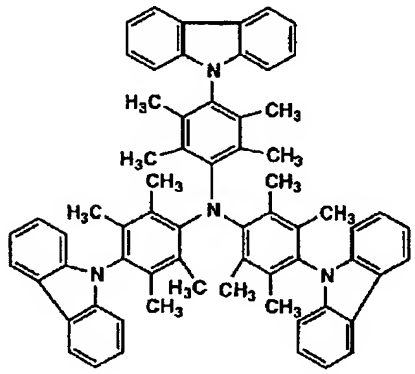

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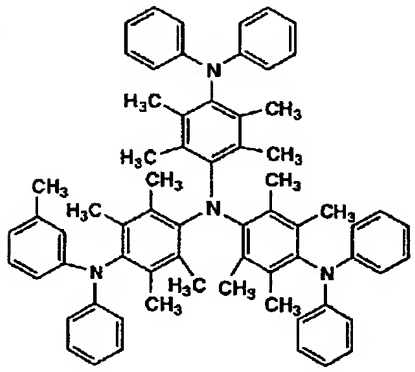
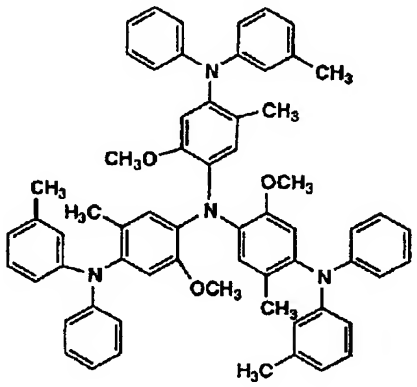


[0072]
[Formula 26]

(67)



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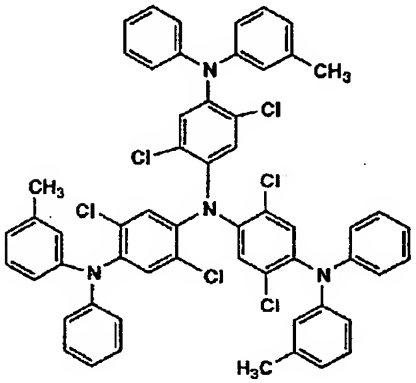


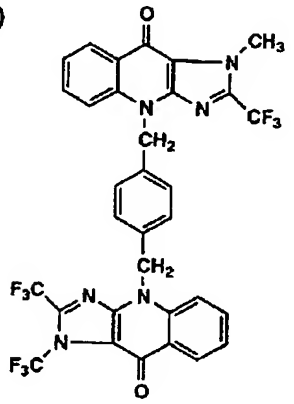
[0073] Moreover, as an example of heterocycle in case said organic compound is a heterocyclic compound which has at least one hetero atom, a pyrrole ring, a pyrrolidine ring, a pyrazole ring, an imidazole ring, a pyridine ring, a benzimidazole ring, a bends thiazole ring, a benzooxazole ring, etc. are raised.

[0074] Although the example of the heterocyclic compound in this invention is shown below, this invention is not limited to these.

[0075]

[Formula 27]

(69)



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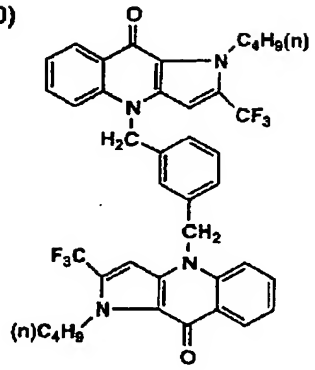

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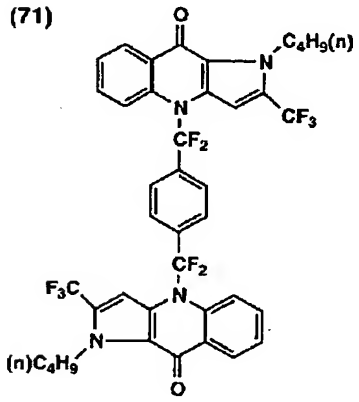

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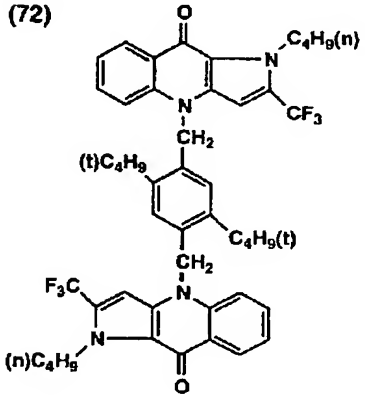

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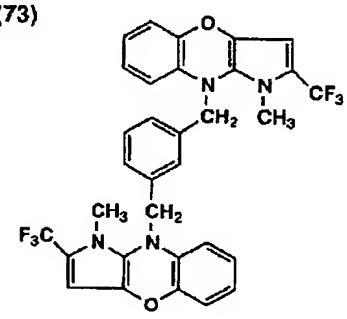
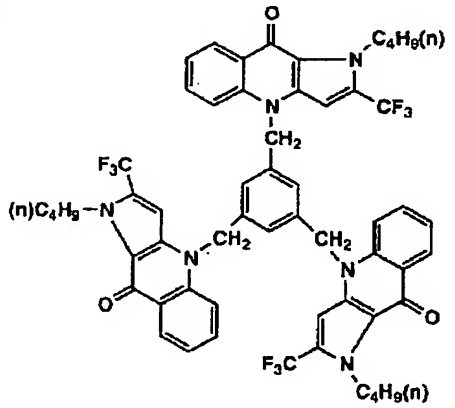


[0076]
[Formula 28]

(74)



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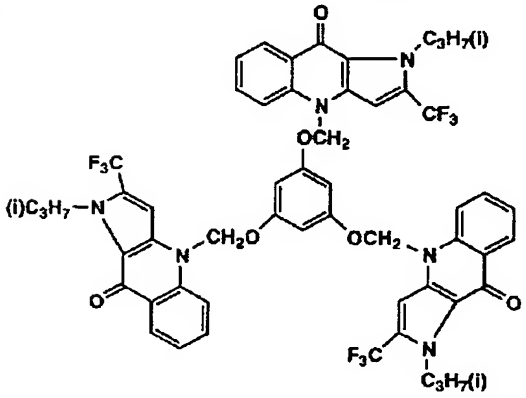

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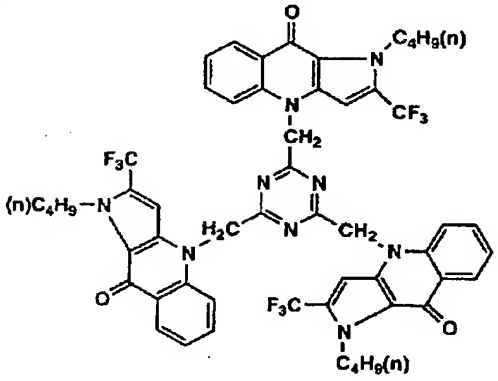
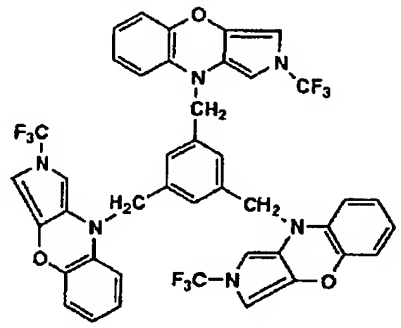


[0077]
[Formula 29]

(77)



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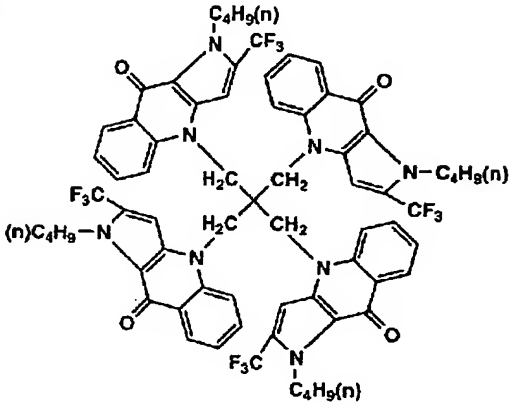

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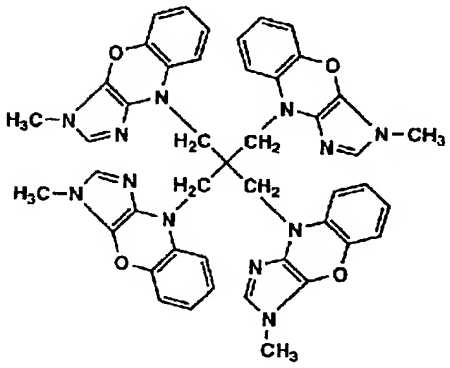
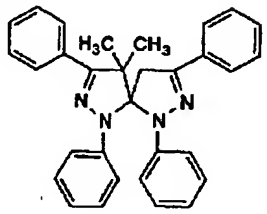


[0078]
[Formula 30]

(80)



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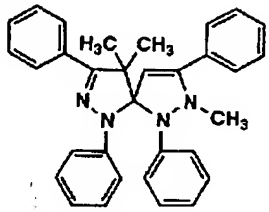

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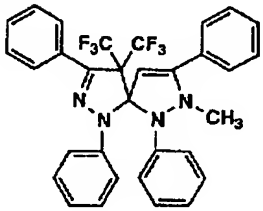

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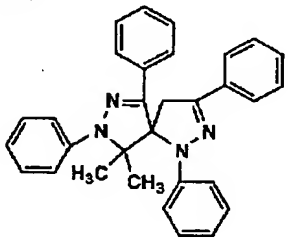

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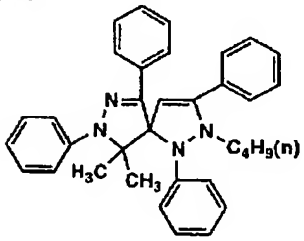

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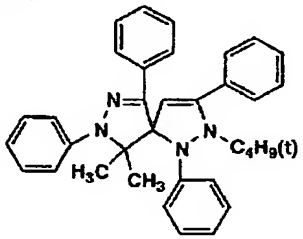


[0079] When said organic compound of this invention has a 3.20eV - 3.60eV band gap, it is desirable especially in respect of luminescence brightness and a component life.

[0080] as the approach of forming a luminous layer using the above-mentioned organic compound and a fluorescent substance — vacuum deposition, a spin coat method, the cast method, and LB — although it can form by thin-film-izing by well-known approaches, such as law, it is desirable that it is especially the molecule deposition film. Here, molecule deposition film is the thin film which deposition was carried out and was formed from the gaseous-phase condition of the above-mentioned compound, and film solidified and formed from the melting condition or liquid phase condition of a compound. usually, this molecule deposition film — LB — it is distinguishable with the thin film (molecule built up film) formed of law, and the difference of condensation structure and higher order structure and the functional difference resulting from it.

[0081] Moreover, after this luminous layer melts the above-mentioned organic compound and a fluorescent substance to a solvent and considers as a solution with binding material, such as resin, as indicated by Provisional Publication No. No. 51781 [57 to], it can thin-film-ize this with a spin coat method etc., and can form it. Thus, although there is especially no limit about the thickness of the formed luminous layer and it can choose suitably according to a situation, it is usually the range of 5nm - 5 micrometers. 0.001-10-mol% of the concentration of the fluorescent substance to be used is desirable to the above-mentioned organic compound.

[0082] Next, an electron hole transportation layer and an electronic transportation layer are explained. An electron hole transportation layer by having the function to transmit the electron hole poured in from the anode plate to a luminous layer, and making this electron hole transportation layer intervene between an anode plate and a luminous layer The electron which many electron holes were poured into the luminous layer by lower electric field, and was further poured into the luminous layer from cathode, the cathode buffer layer, or the electronic transportation layer That the interface in a luminous layer accumulates with the obstruction of the electron which exists in the interface of a luminous layer and an electron hole transportation layer, and luminous efficiency improves etc. becomes the component which was excellent in the luminescence engine performance. About the ingredient (henceforth a hole-injection ingredient and an electron hole transportation ingredient) of this electron hole transportation layer, if it has the aforementioned property, there is especially no limit, and it can choose and use the thing of arbitration in photoconductive material conventionally out of what is commonly used as an electron hole transportation ingredient, or the well-known thing used for the electron hole transportation layer of an EL element.

[0083] The above-mentioned electron hole transportation ingredient may have impregnation of an electron hole, transportation, or electronic obstruction nature, and may be any of the organic substance and an inorganic substance. as this electron hole transportation ingredient — for example, a triazole derivative, an OKISA diazole derivative, an imidazole derivative, the poly aryl alkane derivative, a pyrazoline derivative and a pyrazolone derivative, a phenylenediamine derivative, an arylamine derivative, an amino permutation chalcone derivative, an oxazole derivative, a styryl anthracene derivative, and full — me — non, a derivative, a hydrazone derivative, a stilbene

derivative, a silazane derivative, an aniline system copolymer and conductive polymer oligomer, especially thiophene oligomer, etc. are mentioned. As an electron hole transportation ingredient, although the above-mentioned thing can be used, it is desirable to use a porphyrin compound, an aromatic series tertiary amine compound and a styryl amine compound, especially an aromatic series tertiary amine compound.

[0084] As an example of representation of the above-mentioned aromatic series tertiary amine compound and a styryl amine compound N, N, N', and N'-tetra-phenyl -4, 4'-diamino phenyl;N, N'-diphenyl-N, N'-screw (3-methylphenyl)-[1 and 1'-biphenyl]-4, and 4'-diamine (TPD); 2 and 2-screw (4-G p-tolylamino phenyl) propane; 1 and 1-screw Cyclohexane; The N, N, N', and N'-tetra--p-tolyl -4, 4'-diamino biphenyl;1, a 1-screw (4-G p-tolylamino phenyl)-4-phenylcyclohexane; screw (4-G p-tolylamino phenyl) Phenylmethane; (4-dimethylamino-2-methylphenyl) A screw Phenylmethane;N, N'-diphenyl-N, and N'-JI (4-methoxypheny) -4, a 4'-diamino biphenyl; An N, N, N', and N'-tetra-phenyl -4, 4'-diamino diphenyl ether;4, and 4'-screw (4-G p-tolylamino phenyl) KUODORI phenyl; N, N, and N-Tori (Diphenylamino) Amine; 4- (p-tolyl) (G p-tolylamino)-4'-[4-(G p-tolylamino) styryl] stilbene; -- a 4-N, N-diphenylamino-(2-diphenyl vinyl) benzene;3-methoxy-4'-N, and N-diphenylamino still benzene;N-phenyl carbazole -- further What has in intramolecular two fused aromatic rings indicated by the U.S. Pat. No. 5,061,569 number, For example, a 4 and 4'-screw [N-(1-naphthyl)-N-phenylamino] biphenyl (NPD), 4 and 4' by which the triphenylamine unit indicated by JP,4-308688,A was connected with 3 starburst molds -- 4" (MTDATA) of - tris [N-(3-methylphenyl)-N-phenylamino] triphenylamines etc. is mentioned.

[0085] The polymeric materials which furthermore introduced these ingredients into the macromolecule chain, or used these ingredients as the principal chain of a macromolecule can also be used.

[0086] Moreover, p mold-Si, p mold - Inorganic compounds, such as SiC, can also be used as an electron hole transportation ingredient. this electron hole transportation layer -- the above-mentioned electron hole electron hole transportation ingredient -- for example, a vacuum deposition method, a spin coat method, the cast method, and LB -- it can form by thin-film-izing by well-known approaches, such as law. Although there is especially no limit about the thickness of an electron hole transportation layer, it is usually 5nm - about 5 micrometers. This electron hole transportation layer may be 1 layer structure which consists of a kind of the above-mentioned ingredient, or two sorts or more, and may be a laminated structure which consists of two or more layers of the same presentation or a different-species presentation.

[0087] Furthermore, as the ingredient, the thing of arbitration can be chosen and used for the electronic transportation layer used if needed out of a conventionally well-known compound that what is necessary is just to have the function to transmit the electron poured in from cathode to a luminous layer.

[0088] As an example of the ingredient (henceforth an electronic transportation ingredient) used for this electronic transportation layer, heterocycle tetracarboxylic acid anhydrides, such as a nitration fluorene derivative, a diphenyl quinone derivative, a thiopyran dioxide derivative, and naphthalene perylene, a carbodiimide, a deflection ORENIRIDEN methane derivative, anthra quinodimethan and an anthrone derivative, an OKISA diazole derivative, etc. are mentioned. Furthermore, in the above-mentioned OKISA diazole derivative, the thiadiazole derivative which permuted the oxygen atom of an oxadiazole ring by the sulfur atom, and the quinoxaline derivative which has the quinoxaline ring known as an electron withdrawing group can also be used as an electronic transportation ingredient.

[0089] The polymeric materials which furthermore introduced these ingredients into the macromolecule chain, or used these ingredients as the principal chain of a macromolecule can also be used.

[0090] Moreover, the metal complex (Alq), for example, tris (eight quinolinol) aluminum, of an eight-quinolinol derivative, Tris (5, 7-dichloro-eight quinolinol) aluminum, tris (5, 7-dibromo-eight quinolinol) aluminum, Tris (2-methyl-eight quinolinol) aluminum, tris (5-methyl-eight quinolinol) aluminum, Metal complexes with which the central metal of these metal complexes replaced In, Mg, Cu, calcium, Sn, Ga, or Pb, such as screw (eight quinolinol) zinc (Znq), can also be used as an electronic transportation ingredient. In addition, that by which a metal free-lancer, metal phthalocyanines, or those ends are permuted with the alkyl group, the sulfonic group, etc. can also be preferably used as an electronic transportation ingredient. Moreover, the JISUCHIRIRU pyrazine derivative used as an ingredient of a luminous layer can also be used as an electronic transportation ingredient, and they are n mold-Si and n mold like an electron hole transportation layer. - Inorganic semi-conductors, such as SiC, can also be used as an electronic transportation ingredient.

[0091] this electronic transportation layer -- the above-mentioned compound -- for example, a vacuum deposition method, a spin coat method, the cast method, and LB -- a film can be produced by the thin film-ized method law etc. is well-known, and it can form. The thickness as an electronic transportation layer is usually chosen in 5nm - 5 micrometers, although there is especially no limit. This electronic transportation layer may be 1 layer structure which consists of these electronic transportation ingredient kinds or two sorts or more, or may be a laminated structure which consists of two or more layers of the same presentation or a different-species presentation.

[0092] Furthermore, a buffer layer (electrode volume phase) may be made to exist between an anode plate, a luminous layer, or a hole-injection layer and between cathode, a luminous layer, or an electron injection layer.

[0093] A buffer layer is a layer prepared between an electrode and an organic layer for a driver voltage fall or the improvement in luminous efficiency, it is indicated by piece [2nd] chapter "an electrode material" (123-166 pages) "an organic electroluminescent element and its industrialization front line (November 30, 1998 N tea S company issue)" 2 at the detail, and there are an anode plate buffer layer and a cathode buffer layer.

[0094] As for an anode plate buffer layer, the giant-molecule buffer layer using conductive polymers with which the detail is indicated and is represented by the phthalocyanine buffer layer represented as an example at a copper

phthalocyanine and the vanadium oxide, such as an oxide buffer layer, an amorphous carbon buffer layer, the poly aniline (EMERARU DIN), and the poly thiophene, etc. is mentioned to JP,9-45479,A, 9-260062, 8-288069, etc.
[0095] As for a cathode buffer layer, the oxide buffer layer with which the detail is represented by the metal buffer layer which is indicated and is specifically represented to strontium, aluminum, etc., the alkali-metal-compound buffer layer represented by lithium fluoride, the alkaline earth metal compound buffer layer represented by magnesium fluoride, and the aluminum oxide is mentioned to JP,6-325871,A, 9-17574, 10-74586, etc.
[0096] Especially, in the organic electroluminescent element of this invention, when a cathode buffer layer existed, a driver voltage fall and the improvement in luminous efficiency were obtained greatly.
[0097] As for the above-mentioned buffer layer, it is desirable that it is the very thin film, and although based also on a material, the thickness has the desirable range of 0.1-100nm.
[0098] You may have stratum functionale, such as an electron hole inhibition (hole block) layer which may carry out the laminating of the layer which furthermore has the other functions other than the above-mentioned basic configuration layer if needed, for example, is indicated by the 237th page of JP,11-204258,A, 11-204359, and "the organic electroluminescent element and its industrialization front line (November 30, 1998 N tea S company issue)" etc.
[0099] Next, the electrode of an organic electroluminescent element is explained. The electrode of an organic electroluminescent element consists of cathode and an anode plate.
[0100] What uses the large (4eV or more) metal, the alloy, the electrical conductivity compounds, and such mixture of a work function as electrode material as an anode plate in this organic electroluminescent element is used preferably. As an example of such electrode material, conductive transparent materials, such as metals, such as Au, CuI, indiumtinoxide (ITO), and SnO2, ZnO, are mentioned.
[0101] The above-mentioned anode plate may form a pattern through the mask of a desired configuration at the time of vacuum evaporationo and sputtering of (100-micrometer or more extent) and the above-mentioned electrode material, when a thin film may be made to form such electrode material by approaches, such as vacuum evaporationo and sputtering, and the pattern of a desired configuration may be formed by the photolithography method or it seldom needs pattern precision. When taking out luminescence from this anode plate, it is desirable to make permeability larger than 10%, and below hundreds of ohms / ** of the sheet resistance as an anode plate are desirable. Although thickness is furthermore based also on an ingredient, 10nm - 1 micrometer is usually preferably chosen in 10-200nm.
[0102] What, on the other hand, uses the small (4eV or less) metal (an electron injection nature metal is called), the alloy, the electrical conductivity compounds, and such mixture of a work function as electrode material as cathode is used. As an example of such electrode material, a sodium and sodium-potassium alloy, magnesium, a lithium, magnesium / copper mixture, magnesium / silver mixture, magnesium / aluminum mixture, magnesium / indium mixture, aluminum / aluminum oxide (aluminum 2O3) mixture, an indium, a lithium / aluminum mixture, a rare earth metal, etc. are mentioned. In these, the mixture of the point of endurance over electron injection nature, oxidation, etc. to an electron injection nature metal and the second metal which is a metal with it, for example, magnesium / silver mixture, magnesium / aluminum mixture, magnesium / indium mixture, aluminum / aluminum oxide (aluminum 2O3) mixture, a lithium / aluminum mixture, etc. are suitable. [the large value of a work function and] [more stable than this]
[0103] Furthermore, as cathode used for the organic electroluminescent element of this invention, an aluminium alloy is desirable, it is desirable that especially an aluminum content is under 100 mass % more than 90 mass %, and it is under 100 mass % more than 95 mass % most preferably. Thereby, the luminescence life and the highest attainment brightness of an organic electroluminescent element can be raised very much.
[0104] The above-mentioned cathode can produce such electrode material by making a thin film form by approaches, such as vacuum evaporationo and sputtering. Moreover, below hundreds of ohms / ** of the sheet resistance as cathode are desirable, and 10nm - 1 micrometer of thickness is usually preferably chosen in 50-200nm. In addition, in order to make luminescence penetrate, if either the anode plate of an organic electroluminescent element or cathode is transparent or translucent, it improves [luminous efficiency] and is convenient.
[0105] Especially limitation does not have the substrate preferably used for the organic electroluminescent element of this invention in classes, such as glass and plastics, and if it is the thing of transparence, there will be especially no limit. As a substrate preferably used for the electroluminescent element of this invention, glass, a quartz, and light transmission nature plastic film can be mentioned, for example.
[0106] As light transmission nature plastic film, the film which consists of polyethylene terephthalate (PET), polyethylenenaphthalate (PEN), polyether sulphone (PES), polyether imide, a polyether ether ketone, a polyphenylene sulfide, polyarylate, polyimide, a polycarbonate (PC), cellulose triacetate (TAC), cellulose acetate propionate (CAP), etc., for example is mentioned.
[0107] Next, the suitable example which produces an organic electroluminescent element is explained. The method of producing an EL element which consists of the aforementioned anode plate / anode plate buffer layer / electron hole transportation layer / luminous layer / electronic transportation layer / cathode buffer layer / cathode as an example is explained. First, on a suitable substrate, 1 micrometer or less of thin films which consist of desired electrode material, for example, matter for anode plates, is made to form by approaches, such as vacuum evaporationo and sputtering, so that it may become 10-200nm thickness preferably, and an anode plate is produced. Next, the thin film which consists of an ingredient of an anode plate buffer layer, an electron hole transportation

layer, a luminous layer, an electronic transportation layer, and a cathode buffer layer is made to form on this.
[0108] As the approach of thin-film-izing of this organic thin film layer, although there are a spin coat method, the cast method, vacuum deposition, etc. like the above, especially the point of the homogeneous film being easy to be obtained and being hard to generate a pinhole to a vacuum deposition method or a spin coat method is desirable. The producing-film method different furthermore for every layer may be applied. When adopting vacuum deposition as film production, although it changes with crystal structures, meeting structures, etc. which are made into the class of compound to be used, and the purpose of the molecule deposition film, as for the vacuum evaporationo condition, it is desirable to choose suitably whenever [boat stoving temperature] generally in 50-450 degrees C, a 10-6 to ten to 2 Pa degree of vacuum, the evaporation rate of 0.01-50nm/second, the substrate temperature of -50-300 degrees C, and the range of 5nm - 5 micrometers of thickness.
[0109] A desired EL element is obtained by making the thin film which consists of matter for cathode on it form by approaches, such as vacuum evaporationo and sputtering, after formation of these layers, so that 1 micrometer or less may become 50-200nm thickness preferably, and preparing cathode. Although it is desirable for it to be consistent by one vacuum suction, and to produce from a hole-injection layer to cathode as for production of this organic electroluminescent element, it may give the producing-film method which takes out on the way and is different. In that case, consideration of working under a desiccation inert gas ambient atmosphere is needed.
[0110] Moreover, it is also possible to make production sequence reverse and to produce it in order of cathode, a cathode buffer layer, an electronic transportation layer, a luminous layer, an electron hole transportation layer, an anode plate buffer layer, and an anode plate. Thus, when impressing direct current voltage to the obtained EL element, luminescence can be observed, if + is impressed for an anode plate and about electrical-potential-difference 5-40V is impressed for cathode as a polarity of -. Moreover, even if it impresses an electrical potential difference with a reverse polarity, luminescence is not produced at all, without a current flowing. Furthermore, in impressing alternating voltage, only when an anode plate changes + and cathode changes into the condition of -, it emits light. In addition, the wave of the alternating current to impress is arbitrary and good.
[0111] The organic electroluminescent element of this invention may be used as a kind of lamp like the object for lighting, or the exposure light source, and may be used as an indicating equipment (display) of the type which carries out the direct-vision private seal of projection equipment, static image, and dynamic image of the type which projects an image. A passive-matrix (passive matrix) method or an active matrix is sufficient as the drive method in the case of using it as an indicating equipment for animation playback. Moreover, it is possible to produce a full color display by using two or more sorts of organic electroluminescent elements of this invention which has the different luminescent color. At this time, the same thing of the organic compound of this invention used for a luminous layer is desirable. In such a case, possibility that the ingredient (ingredient used for a buffer layer, an electron hole transportation layer, an electronic transportation layer, etc.) used in addition to a luminous layer can be made the same is high, and examination of optimization of component engine performance, such as luminous efficiency and a component life, becomes easy.
[0112] Next, a color conversion layer is explained. The color conversion layer as used in this specification says the layer which has the function to change the light of a certain wavelength into the light of different wavelength in the sense of a wide sense. The layer containing the matter which emits the light of wavelength which specifically absorbs the light emitted from the luminous layer of an organic electroluminescent element, and is different is said. Thereby, an organic electroluminescent element becomes possible [displaying not only the color of the light emitted from a luminous layer but other colors changed by the color conversion layer].
[0113] As matter which emits the light of wavelength which absorbs the light emitted from the luminous layer of an organic electroluminescent element, and is different, a fluorescent substance is mentioned and it can use properly with wavelength [has an organic fluorescent substance or an inorganic fluorescent substance, and] to change it as a fluorescent substance.
[0114] As an organic fluorescent substance, coumarin system coloring matter, pyran system coloring matter, cyanine system coloring matter, crocodile NIUMU system coloring matter, SUKUARIUMU system coloring matter, oxo-Benz anthracene system coloring matter, fluorescein system coloring matter, rhodamine system coloring matter, pyrylium system coloring matter, perylene system coloring matter, stilbene system coloring matter, poly thiophene system coloring matter, etc. are mentioned.
[0115] As an inorganic fluorescent substance, the thing of a particle 3 micrometers or less has a desirable particle size, and it is desirable that it is an ultrafine particle fluorescent substance near the mono dispersion by which the process was further compounded via the liquid phase process.
[0116] The inorganic system fluorescent substance which an inorganic fluorescent substance consists of with a crystal parent and an activator, or a rare earth complex system fluorescent substance is mentioned.
[0117] Y2O2S which are a crystal parent although the presentation of an inorganic system fluorescent substance does not have especially a limit, The metallic oxide and ZnS which are represented by Zn2SiO4, calcium5(PO4)3Cl, etc., To the sulfide represented by SrS, CaS, etc., Ce, Pr, Nd, Pm, What combined the ion of metals, such as ion of rare earth metals, such as Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, and Yb, and Ag, aluminum, Mn, In, Cu, Sb, as an activator or a coactivator is desirable.
[0118] When a crystal parent is explained in more detail, as a crystal parent, a metallic oxide is desirable. For example, (X)3aluminum 16O27, (X)4aluminum 14O25, (X)3aluminum2Si 2O10, (X)4Si 2O8, (X)2Si 2O6, (X)2P2O7, (X) 2P2O5, (X)5(PO4)3Cl, (X) -- 2Si3O8-2(X) Cl2 -- [-- here, X expresses alkaline earth metal. In addition, a single component or two or more kinds of mixed components are sufficient as the alkaline earth metal expressed with X,

and the mixed ratio is arbitrary and good.] ** — the aluminum oxide permuted with alkaline earth metal [like], silicon oxide, a phosphoric acid, a halo phosphoric acid, etc. are mentioned as a typical crystal parent.
[0119] What blended the metallic element of arbitration with sulfides, and those oxides and sulfides of the thing (sulfide) which changed a part of oxide of rare earth metals, such as a zincky oxide and a sulfide, an yttrium, and GADORIUMU, a lanthanum, and oxygen of the oxide to the sulfur atom, and a rare earth metal as other desirable crystal parents is mentioned.
[0120] The desirable examples of a crystal parent are enumerated below. Mg4GeO5.5F and Mg4 — GeO6, ZnS, and Y2O2 — S, Y3aluminum 5O12, Y2SiO10, Zn2SiO4, Y2O3, BaMgAl 10O17, and BaAl 12O19 (it Ba(s)), Sr, MgO-aAl 2O3, BO (Y, Gd)3, S (Zn, Cd), SrGa2 S4, SrS, GaS and SnO2, and calcium10(PO4) 6 (F —) Cl) — 2 and aluminum (Mg (Ba, Sr), Mn) 10O17 (Sr —), calcium, Ba, and Mg10(PO4) 6 — Cl2, PO (La, Ce)4, CeMgAl 11O19, GdMgB 5O10, Sr2P2O7, Sr4aluminum 14O25, Y2SO4, Gd2O2S, and Gd2 — they are O3, YVO4, and Y(P, V) O4 grade.
[0121] What is necessary is for what was replaced with the element of the same family in part to be sufficient as the above crystal parent and activator, or coactivator, and for there to be especially no limit in elementary composition, to absorb the light of a purple-blue field, and just to emit the light.
[0122] In this invention, a thing desirable as the activator of an inorganic system fluorescent substance and a coactivator is the ion of metals, such as ion of the lanthanoids represented by La, Eu, Tb, Ce, Yb, Pr, etc., and Ag, Mn, Cu, In, aluminum, and 0.001-100-mol% of the amount of dopes is desirable to a parent, and is still more desirable. [0.01-50 mol% of]
[0123] An activator and a coactivator are doped in the crystal by transposing some ion which constitutes a crystal parent to ion like the above-mentioned lanthanoids.
[0124] If the actual presentation of a fluorescent substance crystal is indicated strictly, it will become the following empirical formulas, but since the size of the amount of an activator does not affect an essential fluorescence property in many cases, as long as there is no notice, suppose below that the numeric value of the following x or y is not indicated especially. For example, Sr4-xAl14O25:Eu 2+x writes it as Sr4aluminum14O25:Eu2+ in this invention.

[0125] Although the empirical formula of a typical inorganic system fluorescent substance (a crystal parent and inorganic fluorescent substance constituted with an activator) is indicated below, this invention is not limited to these. 3-x-yAl16O27:Eu 2+x, Mn2+y, (BazMg1-z) Sr4-xAl14O25:Eu 2+x, 1(Sr1-zBaz)-xAl2Si2O8:Eu 2+x, Ba2-xSiO4:Eu 2+x, Sr2-xSiO4:Eu 2+x, Mg2-xSiO4:Eu 2+x, 1(BaSr)-xSiO4:Eu 2+x, Y2-x-ySiO5:Ce 3+x, Tb3+y, Sr2-xP2O5:Eu 2+x, Sr2-xP2O7: — Eu 2+x, 5(BayCazMg1-y-z)-x(PO4)3 Cl:Eu 2+x, Sr2-xSi3O8-2SrCl2:Eu 2+x [x, and y and z express the number of one or less arbitration, respectively.]
Although the inorganic system fluorescent substance preferably used for below by this invention is shown, this invention is not limited to these compounds.
[Blue luminescence inorganic system fluorescent substance]
(BL-1) Sr2P2O7:Sn4+ (BL-2) Sr4aluminum14O25:Eu2+ (BL-3) (Ba, Sr) (Mg —) BaMgAl10O17:Eu2+ (BL-4) SrGa2S4:Ce3+ (BL-5) CaGa2S4:Ce3+ (BL-6) Mn) — aluminum10O17:Eu2+ (BL-7) (Sr and calcium —) Ba, Mg) 10 (PO4) 6Cl2:Eu2+ (BL-8) BaAl2SiO8:Eu2+ (BL-9) Sr2P2O7:Eu2+ (BL-10) Sr5(PO4) 3Cl:Eu2+ (BL-11) (Sr, calcium, Ba) 5(PO4) 3Cl:Eu2+ (BL-12) BaMg2aluminum16O27:Eu2+ (BL-13) (Ba, calcium) 5(PO4) 3Cl:Eu2+ (BL-14) Ba3MgSi2O8:Eu2+ (BL-15) Sr3MgSi2O8:Eu2+ [a green luminescence inorganic system fluorescent substance]
(GL-1) (BaMg) aluminum16O27:Eu2+, Mn2+ (GL-2) Sr4aluminum14O25:Eu2+ (GL-3) (SrBa) aluminum2Si2O8:Eu2+ (GL-4) (BaMg) 2SiO4:Eu2+ (GL-5) Y2SiO5:Ce3+ and Tb3+ (GL-6) Sr2P2O7-Sr2B2O5:Eu2+ (GL-7) () BaCaMg5 (PO4) 3Cl:Eu2+ (GL-8) Sr2Si3O8-2SrCl2:Eu2+ (GL-9) Zr2SiO4, MgAl11O19:Ce3+, Tb3+ (GL-10) Ba2SiO4:Eu2+ (GL-11) Sr2SiO4:Eu2+ (GL-12) (BaSr) SiO4: Eu2+ [a red luminescence inorganic system fluorescent substance]
(RL-1) Y2O2S:Eu3+(RL-2) YAlO3:Eu3+(RL-3) Ca2Y2(SiO4)6:Eu3+(RL-4) LiY9(SiO4)6O2:Eu3+(RL-5) YVO4:Eu3+ (RL-6) CaS:Eu3+(RL-7) Gd2O3:Eu3+(RL-8) Gd2O2S:Eu3+(RL-9) Y(P,V)O4:Eu3+(RL-10) Mg4GeO5.5F:Mn4+(RL-11) Mg4GeO6:Mn4+(RL-12) K5Eu2.5 (WO4) 6.25 (RL-13) Na5Eu2.5 (WO4) 6.25 (RL-14) K5Eu2.5 (MoO4) 6.25 (RL-15) The Na5Eu2.5 (MoO4) 6.25 above-mentioned inorganic system fluorescent substance Surface treatment processing may be performed if needed and what is depended on the physical processing by addition of what is depended on chemical preparation, such as a silane coupling agent, as the approach, the particle of submicron order, etc., the thing further depended on those concomitant use are mentioned.
[0126] The compound which either an aromatic series system or a non-aromatic series system is OK as, and is preferably expressed with the following general formula (B) as an organic ligand which what has Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, etc. as a rare earth metal is mentioned as a rare earth complex system fluorescent substance, and forms a complex is desirable.
[0127] General formula (B) Lx, Ly, and Lz express the atom which has two or more joint hands independently, respectively among a Xa-(Lx)-(Ly)n-(Lz)-Ya type, n expresses 0 or 1, Xa expresses the substituent which has the atom which can be configurated at least in contiguity of Lx, and Ya expresses the substituent which has the atom which can be configurated at least in contiguity of Lz. Furthermore the part of the arbitration of Xa and Lx are condensed mutually, a ring may be formed, the part of the arbitration of Ya and Lz are condensed mutually, a ring may be formed, Lx and Lz are condensed mutually, a ring may be formed, and at least one aromatic hydrocarbon ring or aromatic series heterocycle exists in intramolecular further. Xa-(Lx)-(Ly)n-(Lz)-Ya However, beta-diketone derivative and a beta-keto ester derivative, What transposed the beta-keto amide derivative or the oxygen atom of said ketone to sulfur atom or -N(R201)-, When it expresses the crown ether with which only the number of arbitration transposed the oxygen atom of crown ether, aza-crown ether, thia crown ether, or crown ether to sulfur

atom or -N(R201)-, there may not be an aromatic hydrocarbon ring or aromatic series heterocycle. - In N(R201)-, R201 expresses the aryl group which is not permuted [the alkyl group which is not permuted / a hydrogen atom, a permutation, or /, a permutation, or].

[0128] In a general formula (B), the atoms which are expressed with Xa and Ya and which can be configurated are specifically an oxygen atom, a nitrogen atom, a sulfur atom, a selenium atom, and a tellurium atom, and it is especially desirable that they are an oxygen atom, a nitrogen atom, and a sulfur atom.

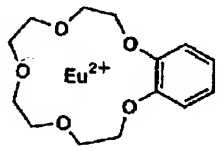
[0129] In a general formula (B), as an atom with two or more joint hands of being expressed with Lx, Ly, and Lz, although there is especially no limit, and a carbon atom, an oxygen atom, a nitrogen atom, a silicon atom, a titanium atom, etc. are mentioned typically, a carbon atom is desirable.

[0130] Although the example of a rare earth complex system fluorescent substance of having the organic ligand expressed with a general formula (B) below is shown, this invention is not limited to these.

[0131]

[Formula 31]

RE-1



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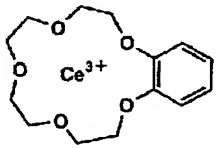

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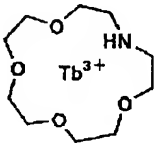

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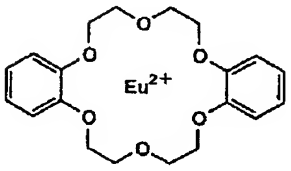

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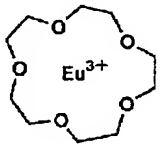

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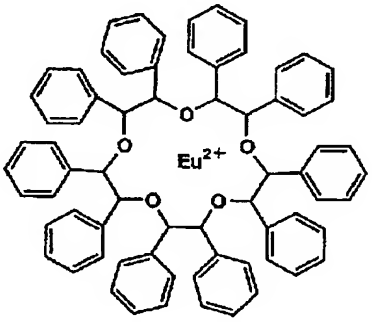

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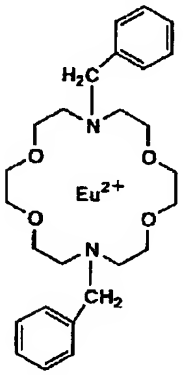

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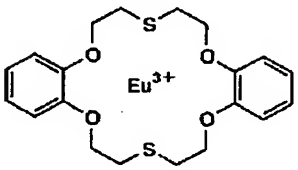
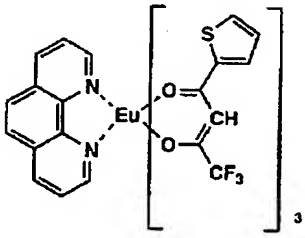


[0132]

[Formula 32]

RE−9



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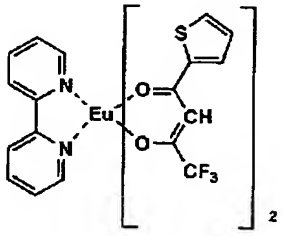

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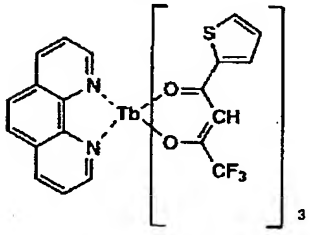

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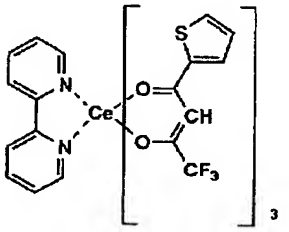

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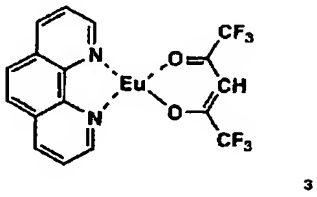

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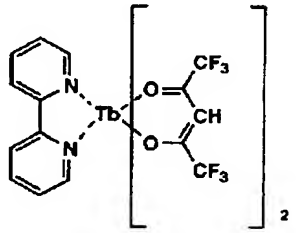

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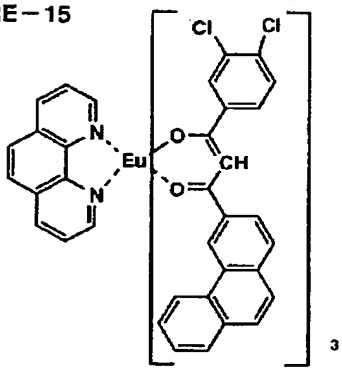
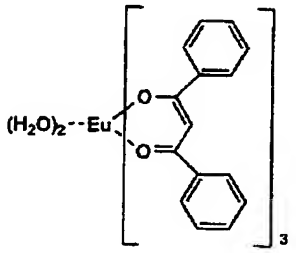


[0133]
[Formula 33]

RE−16



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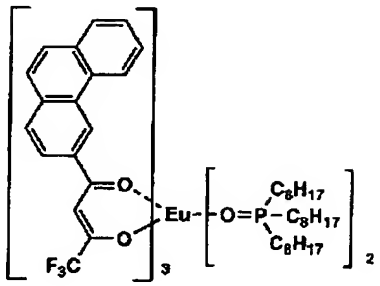

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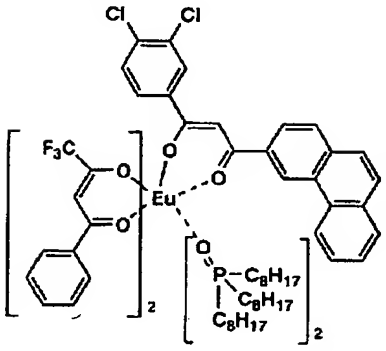

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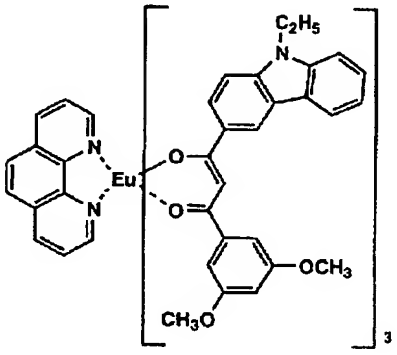

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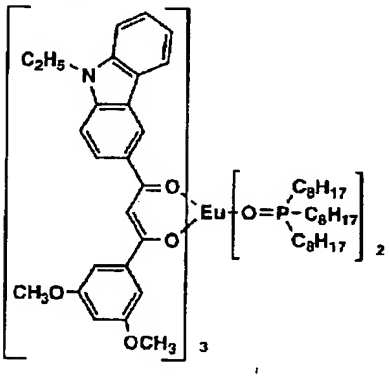

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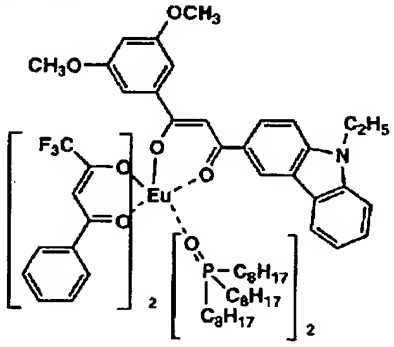
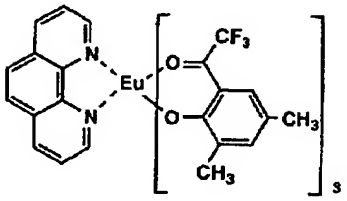


[0134]
[Formula 34]

RF−1



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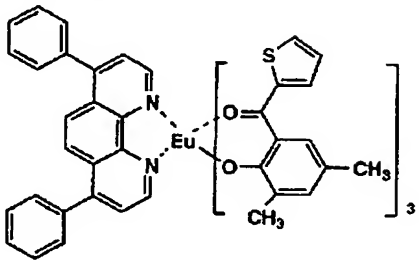
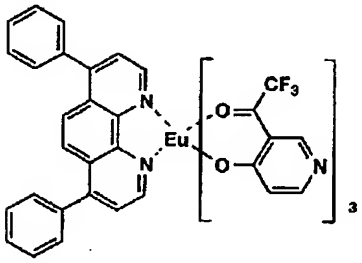
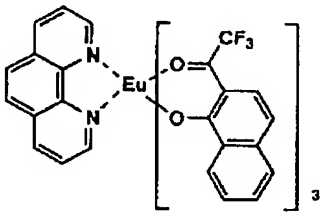


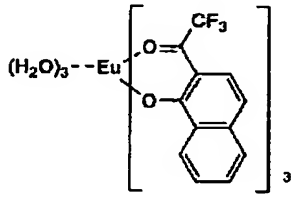
RF−3



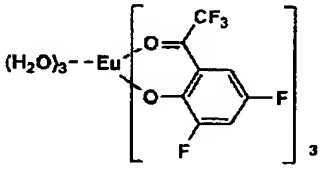
RF−4



RF−5



RF−6



[0135] Although there will be especially no limitation if the location in which a color conversion layer is prepared is the location which can absorb luminescence from the organic electroluminescence section, as for said transparent electrode of a transparence substrate, it is desirable between a transparent electrode and a transparence substrate to prepare in the opposite side (side before taking out luminescence).

[0136] The above-mentioned color conversion layers may be which gestalten, such as vacuum evaporationo or film production according the above-mentioned fluorescent substance to the sputtering method, and spreading film distributed in it by using suitable resin as a binder. 100nm - about 5mm is suitable for thickness. When considering as the spreading film distributed in it by using suitable resin as a binder here, the distributed concentration of a fluorescent substance should just be the range which does not start concentration quenching of fluorescence and can fully absorb luminescence from the organic electroluminescence section. Although based on the class of fluorescent substance, about 10-7 to ten - three mols are suitable to 1g of resin to be used. since concentration quenching hardly poses a problem in the case of an inorganic fluorescent substance -- 1g of resin -- receiving -- 0.1-10 -- it can be used about g.

[0137] The color conversion layer containing the inorganic fluorescent substance which excites on the luminescence wavelength of the organic compound in a luminous layer, has the maximum luminescence wavelength and emits light within the limits of 400-500nm as a color conversion layer used for this invention, The color conversion layer containing the inorganic system fluorescent substance which excites on the luminescence wavelength of the organic compound in a luminous layer, has the maximum luminescence wavelength and emits light within the limits of 501-600nm, It is desirable to excite on the luminescence wavelength of the organic compound in a luminous layer, and to have at least the color conversion layer containing the inorganic system fluorescent substance which has the maximum luminescence wavelength and emits light within the limits of 601-700nm. This becomes possible to make an organic electroluminescent element full color.

[0138] An example of the display which consists of organic electroluminescent elements of this invention is explained below based on a drawing.

[0139] Drawing 1 is the mimetic diagram having shown an example of the display which consists of organic electroluminescent elements. Display image information by luminescence of an organic electroluminescent element, for example, it is the mimetic diagram of the display of a cellular phone etc.

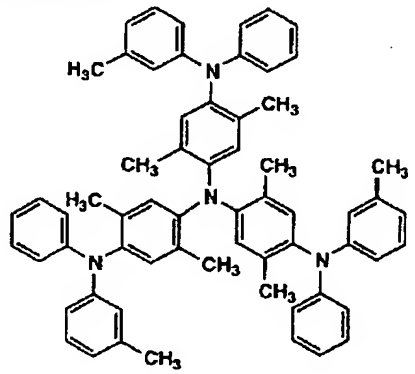
[0140] A display 1 consists of a control section B which performs the image scan of Display A based on the display A which has two or more pixels, and image information.

[0141] It connects with Display A electrically, and based on the image information from the outside, the pixel for every scanning line carries out sequential luminescence of a scan signal and the image data signal according to an image data signal with delivery and a scan signal, and a control section B performs an image scan to two or more

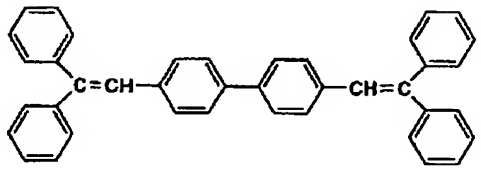
pixels of each, and displays image information on them at Display A.
[0142] Drawing 2 is the mimetic diagram of a display. Display A has the wiring section containing two or more scanning lines 5 and data lines 6, and two or more pixel 3 grades on a substrate. The main members of Display A are explained to below.
[0143] In drawing, the light in which the pixel 3 emitted light shows the case where it is taken out in the direction of a white arrow head (down).
[0144] The scanning line 5 and two or more data lines 6 of the wiring section consisted of an electrical conducting material, respectively, and the scanning line 5 and the data line 6 intersected perpendicularly in the shape of a grid, and it has connected with a pixel 3 in the location which intersects perpendicularly (not shown for details).
[0145] A pixel 3 will emit light according to reception and the received image data in an image data signal from the data line 6, if a scan signal is impressed from the scanning line 5. The full color display of the color of luminescence is attained by juxtaposing suitably the pixel of a red field, the pixel of a green field, and the pixel of a blue field on the same substrate.
[0146] Next, the luminescence process of a pixel is explained. Drawing 3 R> 3 is the mimetic diagram of a pixel.
[0147] The pixel is equipped with the organic electroluminescent element 10, the switching transistor 11, the drive transistor 12, and the capacitor 13 grade. The red of examples 1-3, green, and a blue luminescence organic electroluminescent element can be used for two or more pixels as an organic electroluminescent element 10, and a full color display can be performed by juxtaposing these on the same substrate.
[0148] In drawing 3 , an image data signal is impressed to the drain of a switching transistor 11 through the data line 6 from a control section B. And if a scan signal is impressed to the gate of a switching transistor 11 through the scanning line 5 from a control section B, the drive of a switching transistor 11 will turn on and the image data signal impressed to the drain will be transmitted to the gate of a capacitor 13 and the drive transistor 12.
[0149] While a capacitor 13 is charged by transfer of an image data signal according to the potential of an image data signal, the drive of the drive transistor 12 turns on. A drain is connected to power-source Rhine 7, and, as for the drive transistor 12, a current is supplied to the organic electroluminescent element 10 from power-source Rhine 7 according to the potential of the image data signal with which it connects with the electrode of the organic electroluminescent element 10, and the source was impressed to the gate.
[0150] If a scan signal moves to the following scanning line 5 by sequential scanning of a control section B, the drive of a switching transistor 11 turns off. However, since a capacitor 13 holds the potential of the charged image data signal, an ON state is maintained, and even if the drive of a switching transistor 11 turns off, luminescence of the organic electroluminescent element 10 continues the drive of the drive transistor 12 until impression of the following scan signal is performed. When a scan signal is impressed next by sequential scanning, the drive transistor 12 drives according to the potential of the following image data signal which synchronized with the scan signal, and the organic electroluminescent element 10 emits light.
[0151] namely, the switching transistor 11 and the drive transistor 12 whose luminescence of the organic electroluminescent element 10 is an active component to the organic electroluminescent element 10 of two or more pixels of each -- preparing -- two or more pixels 3 -- light is emitted in each organic electroluminescent element 10. Such a luminescence approach is called the active matrix.
[0152] Here, luminescence of two or more gradation depended on the image data signal with two or more gradation potentials of a multiple value is sufficient as luminescence of the organic electroluminescent element 10, and ON of the predetermined amount of luminescence by the binary image data signal and OFF are convenient for it.
[0153] Moreover, maintenance of the potential of a capacitor 13 may be continued and held to impression of the following scan signal, and it may be made to discharge, just before the following scan signal is impressed.
[0154] In this invention, only when not only an active matrix but the scan signal mentioned above is scanned, the luminescence drive of a passive matrix method which makes an organic electroluminescent element emit light according to a data signal is sufficient.
[0155] Drawing 4 is the mimetic diagram of the display by the passive matrix method. In drawing 4 , two or more scanning lines 5 and two or more image data lines 6 counter on both sides of a pixel 3, and are formed in the shape of a grid.
[0156] When the scan signal of the scanning line 5 is impressed by sequential scanning, the pixel 3 linked to the impressed scanning line 5 emits light according to an image data signal.
[0157] By the passive matrix method, there is no active component in a pixel 3, and reduction of a manufacturing cost can be measured.
[0158]
[Example] Although an example is given and this invention is hereafter explained to a detail, the mode of this invention is not limited to this.
[0159] Example 1 After performing patterning to the substrate (NH techno glass company make: NA-45) which produced 150nm of ITO(s) on glass as a production anode plate of the organic electroluminescent element for a red luminescence organic electroluminescent element (1-1) comparison (OLED 1-1), the transparence support substrate which prepared this ITO transparent electrode was cleaned ultrasonically by i-propyl alcohol, it dried with desiccation nitrogen gas, and UV ozone washing was performed for 5 minutes. This transparence support substrate was fixed to the substrate electrode holder of a commercial vacuum evaporation system. On the other hand, 200mg of m-MTDATXA was put into the resistance heating boat made from molybdenum, 200mg (Alq3) of tris(8-hydroxyquinolinate)aluminium was put into another resistance heating boat made from molybdenum, 200mg (DCM2)

of fluorescent substances was put into the resistance heating boat made from molybdenum of further others, and it attached in the vacuum evaporation system.
[0160] Subsequently, after decompressing a vacuum tub up to 4x10 to 4 Pa, it energized on said heating boat containing m-MTDATXA, heated to 220 degrees C, and vapor-deposited to the transparence support substrate by the evaporation rate 0.1 - 0.3 nm/sec, and the electron hole transportation layer of 60nm of thickness was prepared. The substrate temperature at the time of vacuum evaporationo was a room temperature.
[0161] Furthermore, said heating boat containing Alq3 was energized, and the luminous layer of 40nm of thickness was prepared. At this time, the boat of a fluorescent substance (DCM2) was heated to coincidence, and the fluorescent substance (DCM2) of 5 mass % was mixed to Alq3. Then, only Alq3 was vapor-deposited by the evaporation rate 0.1 - 0.3 nm/sec, and the electronic transportation layer of 20nm of thickness was prepared.
[0162] Next, open a vacuum tub and the rectangle hole vacancy mask made from stainless steel is installed on an electron injection layer. On the other hand, put magnesium 3g into the resistance heating boat made from molybdenum, and 0.5g of silver is put into the basket for vacuum evaporationo made from a tungsten. After decompressing a vacuum tub up to 2x10 to 4 Pa again, energize on the boat containing magnesium and magnesium is vapor-deposited by the evaporation rate 1.5 - 2.0 nm/sec. Under the present circumstances, red luminescence organic electroluminescent element OLED 1-1 for a comparison shown in Table 2 was produced by heating a silver basket to coincidence, vapor-depositing silver by evaporation rate 0.1 nm/sec, and considering as the cathode which consists of mixture of said magnesium and silver.
[0163] (1-2) The cathode of organic electroluminescent element OLED 1-1 produced by production (1-1) of the organic electroluminescent element for a comparison (OLED 1-2 - OLED 1-4) was transposed to aluminum, and the organic electroluminescent element (OLED 1-2) was similarly produced except having vapor-deposited lithium fluoride 0.5nm of thickness, and having prepared the cathode buffer layer between an electronic transportation layer and cathode. Moreover, it transposed to the compound which shows Alq3 of the Alq3 of a luminous layer and the electronic transportation layer of organic electroluminescent element OLED 1-1 in Table 2, respectively, and the organic electroluminescent element for a comparison (OLED 1-3, OLED 1-4) was produced.
[0164] (1-3) It transposed to the compound of this invention which shows Alq3 [of organic electroluminescent element OLED 1-1 produced by production (1-1) of the organic electroluminescent element (OLED 1-5 - OLED 1-25) of this invention] of a luminous layer in Table 2, the electronic transportation layer was transposed to BC, and the organic electroluminescent element (OLED 1-5 - OLED 1-12) was produced. Furthermore, it transposed to the compound of this invention which shows Alq3 of the luminous layer of the organic electroluminescent element (OLED 1-2) produced by (1-2) in Table 2, the electronic transportation layer was transposed to BC, and the organic electroluminescent element (OLED 1-13 - OLED 1-25) was produced.
[0165] Continuation lighting according these components to 15V direct-current-voltage impression was performed under 23 temperature and desiccation nitrogen-gas-atmosphere mind, and the time amount which the luminescence brightness at the time of lighting initiation (cd/m2) and brightness reduce by half was measured. Luminescence brightness was expressed with the relative value which set organic electroluminescent element OLED 1-1 to 100, and the time amount which brightness reduces by half was expressed with the relative value which set to 100 time amount which the brightness of organic electroluminescent element OLED 1-1 reduces by half. A measurement result is shown in Table 2.
[0166]
[Formula 35]

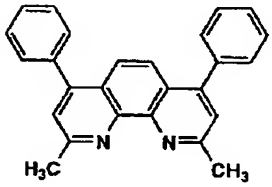
m－MTDATXA



DPVBi



BC



[0167]

[Table 2]

	発光層		陰極	陰極バッファー層	電子輸送層	発光輝度	半減時間	発光色	備考
	有機化合物	蛍光体							
OLED1－1	Alq3	DCM2	Mg－Ag	なし	Alq3	100	100	赤	比較
OLED1－2	Alq3	DCM2	Al	LiF	Alq3	121	119	赤	比較
OLED1－3	Alq3	DCM2	Mg－Ag	なし	BC	95	99	赤	比較
OLED1－4	DPVBi	DCM2	Mg－Ag	なし	BC	93	95	赤	比較
OLED1－5	(7)	DCM2	Mg－Ag	なし	BC	163	405	赤	本発明
OLED1－6	(11)	DCM2	Mg－Ag	なし	BC	145	360	赤	本発明
OLED1－7	(36)	DCM2	Mg－Ag	なし	BC	155	395	赤	本発明
OLED1－8	(38)	DCM2	Mg－Ag	なし	BC	160	401	赤	本発明
OLED1－9	(57)	DCM2	Mg－Ag	なし	BC	159	390	赤	本発明
OLED1－10	(70)	DCM2	Mg－Ag	なし	BC	132	340	赤	本発明
OLED1－11	(74)	DCM2	Mg－Ag	なし	BC	142	388	赤	本発明
OLED1－12	(78)	DCM2	Mg－Ag	なし	BC	136	367	赤	本発明
OLED1－13	(7)	DCM2	Al	LiF	BC	220	491	赤	本発明
OLED1－14	(11)	DCM2	Al	LiF	BC	182	457	赤	本発明
OLED1－15	(18)	DCM2	Al	LiF	BC	196	462	赤	本発明
OLED1－16	(19)	DCM2	Al	LiF	BC	203	480	赤	本発明
OLED1－17	(36)	DCM2	Al	LiF	BC	204	481	赤	本発明
OLED1－18	(38)	DCM2	Al	LiF	BC	208	485	赤	本発明
OLED1－19	(57)	DCM2	Al	LiF	BC	201	475	赤	本発明
OLED1－20	(59)	DCM2	Al	LiF	BC	189	465	赤	本発明
OLED1－21	(62)	DCM2	Al	LiF	BC	185	463	赤	本発明
OLED1－22	(70)	DCM2	Al	LiF	BC	153	426	赤	本発明
OLED1－23	(74)	DCM2	Al	LiF	BC	152	422	赤	本発明
OLED1－24	(78)	DCM2	Al	LiF	BC	155	427	赤	本発明
OLED1－25	(82)	DCM2	Al	LiF	BC	154	426	赤	本発明

[0168] From Table 2, the sample of this invention is understood that the time amount which the luminescence brightness at the time of lighting initiation and brightness reduce [Alq3 (band gap = 2.7eV) and molecular weight of this invention with a band gap out of range] by half as compared with DPVBi with this invention out of range (band gap = 3.15eV, Mw=510) is improved.
[0169] Moreover, it was still more effective when the cathode buffer layer of the organic electroluminescent element of this invention was introduced.
[0170] Example 2 It transposed to the compound which shows the organic compound, the fluorescent substance, the cathode, cathode buffer layer, and electronic transportation layer of a luminous layer of the organic electroluminescent element produced in the green luminescence organic electroluminescent element example 1 in Table 3, and the green luminescence organic electroluminescent element (OLED 2-1 - OLED 2-13) was produced.
[0171] The time amount which the luminescence brightness at the time of lighting initiation (cd/m2) and brightness reduce by half like an example 1 was measured. Luminescence brightness was expressed with the relative value which set organic electroluminescent element OLED 2-1 to 100, and the time amount which brightness reduces by half was expressed with the relative value which set to 100 time amount which the brightness of organic electroluminescent element OLED 2-1 reduces by half. A measurement result is shown in Table 3.
[0172]
[Table 3]

	発光層		陰極	陰極バッファー層	電子輸送層	発光輝度	半減時間	発光色	備考
	有機化合物	蛍光体							
OLED2-1	Alq3	Qd-2	Mg-Ag	なし	Alq3	100	100	緑	比較
OLED2-2	Alq3	Qd-2	Mg-Ag	なし	BC	94	102	緑	比較
OLED2-3	DPVBi	Qd-2	Mg-Ag	なし	BC	94	98	緑	比較
OLED2-4	Alq3	Qd-2	Al	LiF	BC	110	123	緑	比較
OLED2-5	(7)	Qd-2	Mg-Ag	なし	BC	152	403	緑	本発明
OLED2-6	(38)	Qd-2	Mg-Ag	なし	BC	145	399	緑	本発明
OLED2-7	(57)	Qd-2	Mg-Ag	なし	BC	146	388	緑	本発明
OLED2-8	(78)	Qd-2	Mg-Ag	なし	BC	128	360	緑	本発明
OLED2-9	(7)	Qd-2	Al	LiF	BC	198	492	緑	本発明
OLED2-10	(11)	Qd-2	Al	LiF	BC	161	459	緑	本発明
OLED2-11	(38)	Qd-2	Al	LiF	BC	188	481	緑	本発明
OLED2-12	(57)	Qd-2	Al	LiF	BC	185	471	緑	本発明
OLED2-13	(78)	Qd-2	Al	LiF	BC	139	430	緑	本発明

[0173] The same effectiveness as the red luminescence organic electroluminescent element of an example 1 was checked from the result of Table 3.
[0174] Example 3 It transposed to the compound which shows the organic compound, the fluorescent substance, the cathode, cathode buffer layer, and electronic transportation layer of a luminous layer of the organic electroluminescent element produced in the blue luminescence organic electroluminescent element example 1 in Table 4, and the blue luminescence organic electroluminescent element (OLED 3-1 - OLED 3-11) was produced.
[0175] The time amount which the luminescence brightness at the time of lighting initiation (cd/m2) and brightness reduce by half like an example 1 was measured. Luminescence brightness was expressed with the relative value set to 100 of organic electroluminescent element OLED 3-1, and the time amount which brightness reduces by half was expressed with the relative value which set to 100 time amount which the brightness of organic electroluminescent element OLED 3-1 reduces by half. A measurement result is shown in Table 4.
[0176]
[Table 4]

	発光層		陰極	陰極バッファー層	電子輸送層	発光輝度	半減時間	発光色	備考
	有機化合物	蛍光体							
OLED3-1	DPVBi	BCzVBi	Mg-Ag	なし	BC	100	100	青	比較
OLED3-2	DPVBi	BCzVBi	Al	LiF	BC	121	134	青	比較
OLED3-3	(7)	BCzVBi	Mg-Ag	なし	BC	172	421	青	本発明
OLED3-4	(38)	BCzVBi	Mg-Ag	なし	BC	165	413	青	本発明
OLED3-5	(57)	BCzVBi	Mg-Ag	なし	BC	163	403	青	本発明
OLED3-6	(78)	BCzVBi	Mg-Ag	なし	BC	147	383	青	本発明
OLED3-7	(7)	BCzVBi	Al	LiF	BC	242	508	青	本発明
OLED3-8	(11)	BCzVBi	Al	LiF	BC	202	479	青	本発明
OLED3-9	(38)	BCzVBi	Al	LiF	BC	231	502	青	本発明
OLED3-10	(57)	BCzVBi	Al	LiF	BC	209	494	青	本発明
OLED3-11	(78)	BCzVBi	Al	LiF	BC	173	444	青	本発明

[0177] The same effectiveness as the red luminescence organic electroluminescent element of an example 1 was checked from the result of Table 4.
[0178] each which was produced in the example 4 examples 1, 2, and 3 -- red, green, and a blue luminescence organic electroluminescent element were juxtaposed on the same substrate, and the full color display was produced. Continuation lighting by 15V direct-current-voltage impression was performed for these components, and the time amount which the luminescence brightness at the time of lighting initiation and brightness reduce by half was measured. Consequently, it turned out that the time amount in which the luminescence brightness at the time of lighting initiation and brightness reduce by half the full color display of this invention is improved.
[0179] Example 5 The organic electroluminescent element (OLED 5-1) was produced by the same approach except having transposed (7) and a fluorescent substance to DPS (laser coloring matter made from Exiton), and having transposed [the organic compound of a luminous layer of the organic electroluminescent element produced in the display example 1 which has a color conversion layer / cathode] LiF and an electronic transportation layer for aluminum and a cathode buffer layer to BC.
[0180] <Production of the color conversion filter using an inorganic fluorescent substance> Ethanol 15g and gamma-glycidoxy propyltriethoxysilane 0.22g were added to Aerosil of 5nm of mean diameters 0.16g, and it stirred under the open system room temperature for 1 hour. this mixture and 20 (RL-12)g -- a mortar -- moving -- good -- after grinding ****** and 70-degree C oven -- oven (2 hours and 120 more degrees C) -- 2 hours -- heating -- surface treatment -- having carried out (RL-12) -- it obtained.
[0181] Moreover, surface treatment of (GL-10) and (BL-3) was performed similarly. After adding and stirring butyral (BX-1) 30g dissolved in the mixed solution (300g) of toluene / ethanol =1/1 to 10 (RL-12)g which gave the above-mentioned surface treatment, it applied on glass by 200 micrometers of Wet thickness. Stoving of the obtained applied glass was carried out in 100-degree C oven for 4 hours, and the red conversion filter (F-1) with which the color conversion layer was formed on glass was produced.
[0182] Moreover, the green conversion filter (F-2) and (BL-3) the painted blue conversion filter (F-3) which painted (GL-10) by the same approach as this were produced.
[0183] Then, the blue conversion filter (F-3) was stuck on the transparence substrate bottom of an organic electroluminescent element (OLED 5-1) in the shape of a stripe as a color transducer. The organic electroluminescent elements of this example are the following configurations.
[0184] a color transducer / transparence substrate / anode plate / organic compound thin film / **** -- the place which impressed the electrical potential difference of 15V to this component -- 320 cd/m2 -- clear blue luminescence was obtained. The maximum luminescence wavelength of an emission spectrum was set to (0.15, 0.06) on 448nm and a CIE chromaticity coordinate.
[0185] Furthermore, the organic electroluminescent element which replaced the blue conversion filter (F-3) of the above-mentioned color transducer with the green conversion filter (F-2) or the red conversion filter (F-1) was produced. Consequently, from the organic electroluminescent element which prepared the green conversion filter (F-2), the red light on 170 cd/m2, the maximum luminescence wavelength of 615nm, and a CIE chromaticity coordinate (0. 63 0.33) was obtained from the organic electroluminescent element in which the green light on 250 cd/m2, the maximum luminescence wavelength of 532nm, and a CIE chromaticity coordinate (0. 24 0.63) prepared the red conversion filter (F-1), respectively.
[0186] Each luminescence brightness of the above, blue glow, green light, and red light excels the luminescence brightness of the organic electroluminescent element of a publication in the example of patent No. 2795932.
[0187] Moreover, the organic electroluminescent element of the lamination of the following which changed the location of the following color transducers into the transparence substrate bottom was produced.
[0188] a transparence substrate / color transducer / anode plate / organic compound thin film / **** -- the emission spectrum of the above-mentioned blue, green, the almost same maximum luminescence wavelength as red, and a CIE chromaticity coordinate was obtained also in this case.
[0189] In the display A which has two or more pixels 3 of example 6 drawing 2 , the display which used as the organic electroluminescent element (OLED 5-1) given in an example 5 two or more organic electroluminescent elements of all with which two or more pixels 3 are equipped was produced. When the electrical potential difference was impressed to the display at this time, luminescence of a purple-blue color was obtained from all the pixels 3.
[0190] Next, the organic electroluminescent element (drawing 5 (b)) to which the location of a transparence substrate and a color conversion layer differs from the organic electroluminescent element (drawing 5 (a)) of a publication and this in the example 5 was produced. Drawing 5 is the sectional view which looked at the organic electroluminescent element which has a color conversion layer from thickness. In drawing 5 (a), the organic electroluminescent element 10 turns the organic electroluminescence section Y 10d bottom of glass transparence substrates, and is turning the laminating of the color transducer X down.
[0191] 10a of a reference mark is the cathode made from aluminum among drawing, and 10b is the color conversion layer which juxtaposed the red conversion filter (F-1) which a transparence substrate and 10e produced the organic compound thin film and 10c which are included in the anode plate (ITO transparent electrode), and was produced in the example 5 10d, the green conversion filter (F-2), and the blue conversion filter (F-3) in the shape of a stripe a luminous layer (an organic compound (7) and a fluorescent substance DPS are included).
[0192] When the current was supplied to organic compound thin film 10b through cathode 10a and transparent electrode 10c, light was emitted according to the amount of currents. Luminescence at this time was taken out in

the bottom direction in drawing. And the light which emitted light is absorbed by color conversion layer 10e through 10d of transparence substrates. When a color conversion layer has red conversion ability (red conversion filter (F-1) part), a red field, When it had green conversion ability (green conversion filter (F-2) part) and had the blue conversion ability of a green field (blue conversion filter (F-3) part), luminescence of the color of a blue field was able to be taken out in the direction like a ****** arrow head.

[0193] As shown in drawing 5 (b), even when the laminating of the color transducer X and the organic electroluminescence section Y was carried out to 10d bottom of transparence substrates in this sequence, red and green and blue luminescence were obtained like the case of drawing 5 (a).

[0194]

[Effect of the Invention] By this invention, the improvement in luminous efficiency or the organic electroluminescent element which carried out reinforcement and the low power using this, and a long lasting display can be offered. Moreover, the low cost display using this organic electroluminescent element and a color conversion layer can be offered.

[Translation done.]

TECHNICAL FIELD

[Field of the Invention] This invention relates to the display which has an organic electroluminescent element and it excellent in luminescence brightness and a life in detail about an organic electroluminescence (it may be written as organic electroluminescence below) component, and a display.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] By this invention, the improvement in luminous efficiency or the organic electroluminescent element which carried out reinforcement and the low power using this, and a long lasting display can be offered. Moreover, the low cost display using this organic electroluminescent element and a color conversion layer can be offered.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] The first purpose of this invention is offering the improvement in luminous efficiency or the organic electroluminescent element which carried out reinforcement and the low power which used this, and a long lasting display. The second purpose is offering the display of the low cost which used this organic electroluminescent element and a color conversion layer.

[Translation done.]

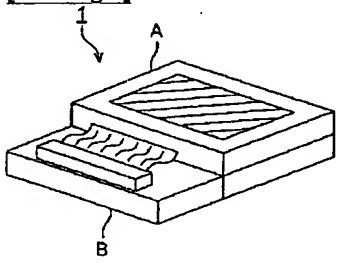
DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the mimetic diagram having shown an example of the display which consists of organic electroluminescent elements.
[Drawing 2] It is the mimetic diagram of a display.
[Drawing 3] It is the mimetic diagram of a pixel.
[Drawing 4] It is the mimetic diagram of the display by the passive matrix method.
[Drawing 5] It is the sectional view which looked at the organic electroluminescent element which has a color conversion layer from thickness.
[Description of Notations]
1 Display
3 Pixel
5 Scanning Line
6 Data Line
7 Power-Source Rhine
10 Organic Electroluminescent Element
10a Cathode
10b Organic compound thin film
10c Transparent electrode
10d Transparence substrate
10e Color conversion layer
11 Switching Transistor
12 Drive Transistor
13 Capacitor
A Display (display)
B Control section
X Color transducer
Y Organic electroluminescence section

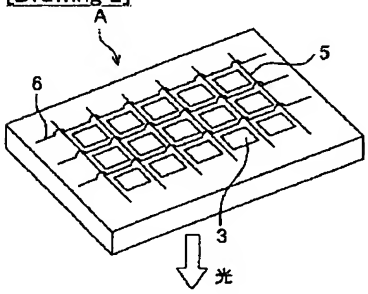
[Translation done.]

DRAWINGS

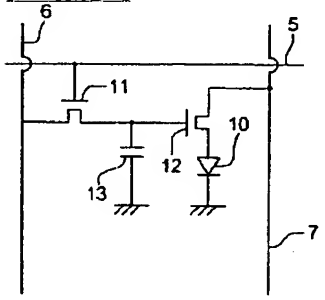
[Drawing 1]



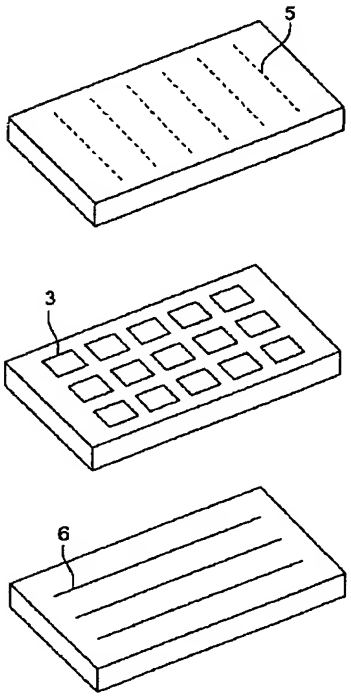
[Drawing 2]



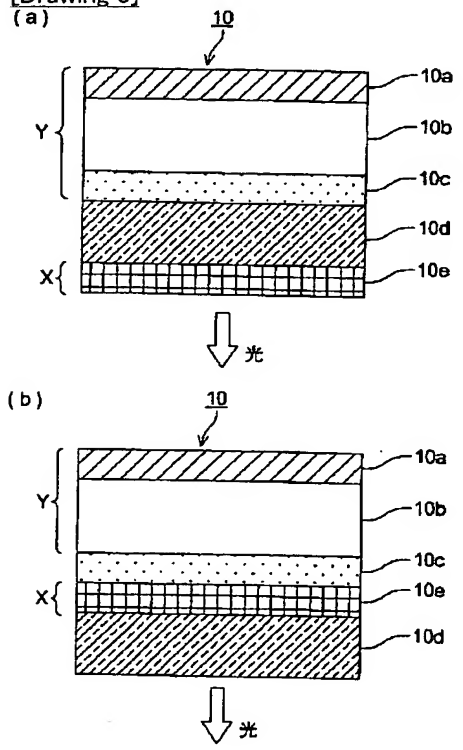
[Drawing 3]



[Drawing 4]



[Drawing 5]



[Translation done.]